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(54) **LIQUID OUTLET ADAPTED TO PROVIDE LIGHTING EFFECTS AND/OR FOR ILLUMINATION.**

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Description

This invention relates to liquid outlets. The liquid outlets with which the invention may be associated (but is not to be limited to) may include domestic watertaps or -faucets, beverage dispensers, hose spouts, fountain spouts, industial spouts and the like.

It is an object of this invention to provide liquid outlets whereby the liquid stream provides a source of illumination.

No prior art is known in relation with domestic watertaps or waterfaucets, beverage dispensers, hose spouts or industrial spouts.

In relation to water fountains it is known to illuminate such water fountains from outside, whereby the illumination is by means of reflection from light sources which are generally hidden from view and are directed onto the water jets. While such illumination effects can be quite effective, the available light is not used effectively since the visual effect results from that light which is reflected from the water jets to the eye and much of the light is either transmitted past the jets or through the jets. In addition since the light sources must be located around or closely adjacent to the water jets it is often the case that from particular positions around the fountain an observer is dazzled by the lights which impairs the view of the fountain.

Several alternatives to this conventional fountain illumination have been proposed in the past. Examples of such prior art are disclosed in GB-A-2 099 125, FR-A-1 187 689, US-A-3 866 832.

According to GB-A-2 099 125, a lightsource (15) is located in a housing (12-14) through which the water flows, which housing is equiped with a plurality of outlets (24, 26). The coupling of light into the emerging stream of liquid does not happen inside these outlets, but in said separate housing, whereby only a small part of the light produced by lightsource (15) is introduced in the jets, while most of the light is diverted through the transparent covering (12) of said housing in order to illuminate the jets from outside. Moreover, the dimensions of the lightsource (15) are far larger than the dimensions of the outlets (24, 26). In the present application, the lightsource is always smaller than the outlet, because it is to be accommodated within the liquid outlet.

According to FR-A-1 187 689, light from a lightsource (4) is projected through a chamber (8) towards an outlet (3). Here again, the lightsource is not accommodated within the outlet (3), while also due to the extended dimensions of the arrangement, it has to be hidden behind an opaque wall (2), through which the outlet (3) is protruding.

According to US-A-3 866 832, a nozzle assembly (10) for a fountain creates a hollow column of water, having a longitudinal slot (22) exposing the hollow, which hollow is illuminated by a lamp (18). The object of said invention is not to create a solid jet of water that is internally illuminated, which is the object of the present invention.

It is an object of this invention to provide a liquid outlet whereby light can be introduced into a liquid stream inside the liquid outlet adjacent to the discharge opening of said liquid outlet, in order that maximum light input into the liquid stream emerging from said discharge opening is effected with minimum of losses.

In one form the invention resides in an apparatus, comprising a liquid outlet, having a supply opening connected to a pressurised source of liquid, and having a discharge opening capable of producing a substantially non-turbulent and/or low turbulent stream of liquid at said discharge opening for a distance beyond said discharge opening, and a light source to introduce light into said stream of liquid at the discharge opening.

In one preferred form of the above invention the light source comprises a lamp located within said liquid outlet and supported in a holder which is in heat exchange relationship with the liquid flowing through the liquid outlet.

According to a preferred feature of the invention the light source is optically coupled to the discharge opening.

According to a preferred feature of the above feature the lamp is located adjacent to the discharge opening.

According to a further preferred feature of the invention the light source is located remote from the discharge opening and a light guide provides the optical coupling between the light source and the discharge opening.

It is the aspect of the present invention to provide for means whereby the liquid stream emerging from a watertap or -faucet, a beverage dispenser, a hose spout, a fountain spout or the like serves as a source of illumination and/or a lightguide to deliver light to the portion of the stream at which the stream becomes turbulent.

In addition the invention provides a means whereby a surface may be illuminated by having a liquid stream directed at a surface whereby the light is reflected by the surface at the point of impact of the logical stream.

The invention will be more fully understood in the light of the following description of several specific embodiments. The description is made with reference to the accompanying drawings of which:

Figs. 1, 2 and 3 illustrate the optics associated with the invention;

Fig. 4 illustrates a domestic faucet incorporating the first embodiment;

Fig. 5 illustrates a domestic faucet incorporating the second embodiment:

Fig. 6 illustrates the third embodiment of the invention;

Fig. 7 illustrates a fourth embodiment of the invention;

Fig. 8 illustrates a fifth embodiment of the invention;

Figs. 9a and 9b are a sectional plan view and an elevation of a sixth embodiment of the invention;

Fig. 10 illustrates a domestic faucet incorporat-

ing the seventh embodiment of the invention;

Figs. 11a and 11b illustrate a faucet having two forms of the eighth embodiment of the invention;

Figs. 12a and 12b illustrate a faucet having two forms of the ninth embodiment of the invention;

Figs. 12c, 12d and 12e illustrate another liquid outlet according to the ninth embodiment of the invention;

Fig. 13 is a sectional elevation of a fountain spout according to the tenth embodiment of the invention;

Fig. 14 is a sectional elevation of another form of fountain spout incorporating the eleventh embodiment of the invention;

Fig. 15 is an elevation of another form of fountain spout incorporating the twelfth embodiment of the invention;

Figs. 16 is a sectional elevation of a fountain comprising a descending stream of water incorporating the thirteenth embodiment of the invention; and

Fig. 17 is a view of the fourteenth embodiment of the invention.

The principle on which the invention of each of the embodiments thereof relies relates to the total internal reflection of light on its passage from a medium of high refractive index to a medium of lower refractive index at the boundary between the two media, provided the angle of incidence is greater than or equal to the critical angle for such media. Even where the angle of incidence is less than the critical angle there will also be a degree of reflection of the light back into the media rather than passage beyond the boundary. Each of these phenomena are illustrated at Figs. 2a and 2b. Where the light is projected from a light source into a stream of water 11 issuing from a nozzle 12 predominantly most of the light will be totally internally reflected within the column until such time as turbulence is introduced into the column at which time the light will be caused to pass from the column causing the turbulent portion of the column to emit light. As shown at Fig. 1 as a result the column of water or jet of water functions as a light guide provided the boundary conditions between water and air are such as to allow total internal reflection, light being transmitted through the column. In addition the jet of water itself may become visible due to the presence of foreign particles in the water, bubbles or the like as is pointed out by arrow A in Fig. 3.

As shown at Fig. 3 where a substantially non-turbulent stream of liquid 11 issues form a liquid outlet 12 and strikes a surface 13 the area of impact of the jet will be illuminated producing a spectacular display.

It is the spectacular nature of the visual effects produced by the light within the column of water and its eventual escape therefrom that is the object of each of the embodiments described below.

The first embodiment shown at Fig. 4 comprises a water faucet 11 controlled by a tap 14 and having an extended water delivery spout or liquid outlet 15 with a discharge opening 16. The interior of the liquid outlet 15 accomodates a lamp housing 17 adjacent the discharge opening 16 which supports a halogen-quartz lamp 18, the transparent outer end 19 of the lamp housing 17 adjacent the discharge opening 16 is formed hydrodynamically to avoid the creation of turbulence associated with cavitation (which will cause light from lamp 18 to be dispersed, whence less light will reach discharge opening 16) in the liquid flow passing through the liquid outlet 15 to the discharge opening 16 past the lamp housing 17. In addition the formation of the outer end of the lamp housing to avoid such turbulence creates a condenser lens 19 which serves to focus the light issuing from the lamp housing. Moreover, lamp housing 17 and fluid stream will be in heat-exchange relationship, whereby sufficient cooling of the lamp housing is guaranteed.

The lamp housing 17 may be fitted with reflective surfaces on the inside in order to maximise light output towards discharge opening 16. The liquid outlet 15 is formed with a channel 20 which extends substantially the full length of the liquid outlet and opens at a position which would be normally out of view to allow for the accommodation of electrical cables for the lamp 18. The portion of the channel 20 adjacent the lamp housing 17 is increased in its lateral dimension and is associated with a closure 21 to provide access to the rear of the lamp housing for replacement of the lamp 18. The activation of the lamp 18 is effected by a control which is sensitive to the operation of the tap 14 to effect flow of water through the nozzle 15 or alternatively a flow sensitive member located in the water stream.

When the jet, leaving such liquid outlet, has an irregular surface, light will emerge from the jet along its length at those points where internal reflection is not total. Hereby the liquid stream (water stream) achieves an increased visibility, which, apart from esthetic effects, can be of advantage in situations where illumination is poor or when an increased visibility of the liquid jet is desired. Whenever the jet has a very smooth boundary surface, conditions for total internal reflection are met all along the liquid stream, hereby the presence of light will not become apparent and the jet will have a normal clear aspect, until after the stream has been rendered turbulent or strikes a surface.

Also, when the continuity of such smooth, normal looking but light-conducting jet, is disrupted over a very short distance, for instance by rapidly moving an object (e.g. a piece of wire) through the jet at right angles to the jet, light will emanate from the jet at this discontinuity, which discontinuity will then become visible and appear as a blob of light. As the discontinuity moves along the jet at the speed of the liquid in the jet, this blob of light will appear to be moving along the jet, thus providing a spectacular effect. Means may be provided to disrupt the continuity of such light-conducting jets according to certain time-patterns.

When a smooth, normal looking, but light-

conducting, jet is directed downward, the diameter of the jet will decrease as function of its length, as the velocity of the liquid in the jet will increase due to gravity, thus concentration of the light contained in the jet occurring, untill cohesive forces of the molecules of the liquid will cause the jet to break up into drops. In this region of the jet, all light, now concentrated in the thin jet just before it breaks up, will leave the jet and radiate intensely to the surroundings, providing for a very bright effect.

However, any particle of foreign matter, either coloured, fluorescent, or having any other properties, or air or gas bubble, contained in the fluid flowing from the liquid outlet 15 will scatter light that is within the jet, which light may hit the surface of the jet at angles smaller than the critical angle, and thus become visible.

In both cases above, i.e. the irregular, bright-looking jet, and the smooth, normal looking jet, light is present within the jet. As a result when filling a receptacle with such liquid jet, light will spread inside the receptacle, thereby illuminating the receptacle from the inside which in general facilitates inspection, while a spectacular effect is provided when a transparent receptacle such as a glass is being filled from the liquid outlet.

The second embodiment of Fig. 5 also relates to a water faucet 11 operated by a valve 14 having a water delivery spout or liquid outlet 15 formed with an discharge opening 16. An intermediate chamber 22 is located between the tap 14 and the lower end of the liquid outlet 15 and accommodates a lamp housing 17 having a window directed towards the lower end of the spout/liquid outlet 15. The lamp housing 17 accommodates a halogen lamp 18 which housing 17 is in heat exchange relationship with the liquid in the intermediate chamber 22, and which directs light into the lower end of the liquid outlet 15, the interior surface of which is formed to be smooth and made reflective by a reflective coating 23a. As with the first embodiment the operation of the lamp 18 is effected through a switch associated with the tap 14, a pressure-or flow-sensitive switch or an electronic switching device in the water stream. Due to the reflective nature of the interior of the liquid outlet and the substantially parallel configuration of the side walls the liquid outlet 15 serves as a light guide which provides optical coupling between a lamp 18 and the discharge opening 16.

The third embodiment of Fig. 6 relates to a faucet similar to the form of the second embodiment of Fig. 5 except that the interior of the spout/liquid outlet 15 is formed for a significant portion of the distance between the chamber 22 and the discharge opening 16 by a tubular liner 23 which is formed of a transparent material such as perspex. The exterior face of the liner is spaced from the internal wall of the liquid outlet to form an air gap 23b therebetween and suitable sealing means 24 is provided at either end of the liner to prevent the entry of liquid into that space. The light from the lamp 18 is optically coupled to the discharge opening 16 by the light guide which is formed by the tubular liner and the water being conducted therethrough. The light on its passage through the liquid outlet 15 is partially reflected by the internal surface of the tubular liner 23, and partially refracted into the wall of the tubular liner 23, which portion of light will undergo total internal reflection at the external surface of the tubular liner when the angle of incidence onto that surface is greater than the critical angle. Light reflected from that surface will strike again the internal surface of the tubular liner, and be refracted as well as reflected, or undergo total internal reflection.

Thus, the tubular liner serves as a hollow light guide, whereby light is conducted in the wall of the tubular liner as well as in the liquid conducted herethrough.

The tubular liner 23 may be coated with a transparent material having an index of refraction lower than the material of the tubular liner 23, thus providing for a hollow light guide, that does not depend on the presence of the air gap 23b.

Moreover, when the interior wall of liquid outlet 15 between chamber 22 and discharge opening 16 is covered with a transparent material having an index of refraction smaller than the index of refraction of the liquid it conducts, light will undergo total internal reflection at this surface whenever the angle of incidence is greater than the critical angle involved, thus, light from light-source 18 will be conducted through the liquid to discharge opening 16.

An alternative form of the embodiment comprises exposing the tubular liner such that at least the free end portion of the liner is exposed. As a result when water is flowing from the liquid outlet the end of the liquid outlet glows and may project some light onto the exterior of the jet of water.

The fourth embodiment of Fig. 7 also comprises a modification of the second embodiment of Fig. 5 whereby the light guide 25 is a conventional flexible light guide consisting of glass fibres, synthetic fibres, or being fluid filled, accommodated within a conduit (channe1) 26 inside of the liquid outlet 15.

The channel 26 may be closed sealingly to prevent entry of water into it.

If the conventional light guide is resistant to the influence of water, the channel 26 may be superfluous. The outer end of the channel 26 supports a closure which is hydro-dynamically shaped to prevent the production of turbulence and associated cavitation within the jet stream flowing from the discharge opening 16 and to provide a condensing effect for the light emanating from the light guide 25.

The fifth embodiment of Fig. 8 is also a variation of the second embodiment of Fig. 5 whereby the light guide comprises a clear transparent rod 25a supported within the liquid outlet by spacer elements 27 at spaced intervals along its length and which extends between the lamp (not shown) and the discharge opening 16. Here, the guiding of light is based on the difference of

index of refraction between the material of the rod and the surrounding liquid. e.g. in case of perspex and water being 1.49 and 1.33 respectively.

The sixth embodiment as shown at Figs. 9a and 9b relates to a liquid outlet 28 having an discharge opening 29, that is directed more or less at right angles with respect to the longitudinal axis of the liquid outlet, located more or less remote from the taps. The liquid outlet 28 supports a lamp housing 30 adjacent the discharge opening 29 and accommodates a lamp 31. The housing 30 is formed with a window directed at the discharge opening 29 while the remaining interior face of the housing 30 is rendered reflective to direct any light incident thereon to the window and thus to the jet stream 29. The operation of the lamp 31 is effected by operation of the taps associated with the liquid outlet 28 or a flow control switch, pressure sensitive switch or electronic switching device sensitive to the flow, pressure or presence of water through the liquid outlet or conduits connected thereto. The electrical cables for the lamp 31 are accommodated within a channel 32 located within the liquid outlet 28 while the wall of the channel opposite the lamp housing 30 is provided with a closure which facilitates access to the lamp for the replacement thereof.

The seventh embodiment of Fig. 10 is a modification of the sixth embodiment of Fig. 9 whereby the lamp 31 is accommodated within a hydrodynamically shaped housing 30 supported in spaced relation within the liquid outlet 28. The lamp is located closely adjacent a concave mirror 34 whereby light from the lamp which is incident on the mirror 34 is directed to the discharge opening 29. The electrical cable connected to the lamp 31 is accommodated within a flexible conduit extending through the liquid outlet 28, passing out of the liquid outlet at some suitable location out of view, and opening up to atmosphere. Due to the flexible nature of the conduit 35 and the direct relation with atmosphere, any pressure variations produced within the housing 31 and the conduit 35 by the presence or absence of fluid flow through the liquid outlet 28 and the heat produced by the light source may be readily accommodated.

The eighth embodiment of Figs. 11a and 11b is a further modification of the sixth embodiment of Fig. 9. The first form shown at Fig. 11a utilises a rod shaped clear transparent light guide 36 supported within the liquid outlet 20 by spacer elements (not shown), and is formed at its outer end with an oblique reflective face which reflects any light reaching the end of the light guide 36 towards the discharge opening 29. The form shown at IIb accommodates a conventional flexible light guide 36 within a sealed channel 38. A plane or concave mirror is located adjacent to the free end of the light guide 36 to direct any light emanating from the light guide to the discharge opening 29.

Again, the channel 38 is superfluous if the flexible light guide is resistant to the influence of the liquid.

The ninth embodiment of Figs. 12a and 12b comprise two forms which utilise the liquid being conducted by the liquid outlet 28 as the light conducting medium. In the case of the first form shown at Fig. 12a the interior of the liquid outlet 28 supports a tubular liner formed of a clear transparent material such as perspex the external walls of which are spaced from the internal walls of the liquid outlet 28 and either end of the space so created is sealed to prevent the entry of any water. As in the case of the third embodiment of Fig. 6 light from a remotely located lamp (not shown) is conducted to the outer end of the liquid outlet by the water flowing through the liquid outlet and the walls of the tubular element. The outer end of the liquid outlet 28 supports a concave mirror which directs any light incident thereon which has passed through the liquid outlet 28 to the discharge opening 29. In the case of the second form of the embodiment (fig. 12b) the internal walls of the liquid outlet 28 are rendered smooth and reflective.

It should be appreciated that the discharge openings of the liquid outlets described until now can take any form or shape, circular, oval, rectangular, elongated, etc. Thus, a particular embodiment, as shown in Fig. 12c and 12d, may have an elongated slit-like discharge opening to produce a sheet of water, e.g. to be used as a waterfaucet controlled by taps remote from the liquid outlet, or as a fountain display.

Here again, the lampholder 101 is in heat-exchange relationship with the liquid, and light emanating from lamp 107, is directed via window 102 into the liquid entering the liquid outlet via inlet 100 towards dicharge opening 103, in a direct manner and/or indirectly via the internal wall of the liquid outlet which is rendered reflective, into the liquidstream 104.

The window 102 may be hydro-dynamically shaped to avoid creation of turbulance and associated cavitation. However, when the velocity of the liquid will be sufficiently low, the window does not necessarily have to be hydro-dynamically shaped. Thus, the window 102 can be made hollow, as in Fig. 12e, such that a light condensing effect is created by the liquid in the hollow 106 of window 102, while sufficient cooling is still guaranteed, and concentration of light directed towards the discharge opening is maximized.

Alternatively, one or more prisms or optical grids may be positioned between lightsource and discharge opening at or near window 102, such that the sheet of water, being expelled from such elongated discharge opening, contains light of different colours at different positions along the length of the discharge opening, in the same order as occurs in a rainbow, as is pointed out by the characters R (red), Y (yellow), V (violet) in Fig. 12c. Such watertap or faucet, or fountain, may be called appropriately a "rainbow"-tap, -faucet, or -fountain.

Naturally, colorfilters may be placed between the lightsource and the discharge opening in order to create any combination of colours of the light conducted in the jet.

The tenth embodiment of Fig. 13 is directed

towards a fountain spout 41 which supports a lamp housing 44 accommodating a lamp 45, located immediately prior to the discharge opening 43. The lamp housing 44 is hydro-dynamically shaped to avoid the creation of any turbulence in the liquid stream leaving the discharge opening and as a result the window of the lamp housing 44 created by such shaping may serve as a condenser lens. The internal surface of the liquid outlet beyond the lamp housing 44 is rendered reflective (by a coating 46) to ensure that any light incident thereon is directed to the discharge opening 43.

The eleventh embodiment of Fig. 14 is a variation of the tenth embodiment of Fig. 13 providing a lamp housing 44 of reduced dimensions, such that the liquid outlet may have a reduced cross-sectional diameter (20 mm or less), enabling long slender liquid outlets of any bend or curved form producing light conducting liquid jets, without any sign proving the presence of a light source being visible from the outside.

In the tenth and eleventh embodiments of Figs. 13 and 14 the electric cables for the lamp 45 are accommodated within a flexible conduit 47 extending through the water conduits providing the water supply for the fountain and exiting therefrom at some suitable location. The flexible nature of the conduit which opens to atmosphere at its outer end ensures that any pressure variations induced within the lamp housing 44 and the conduit 47 are accommodated.

The twelfth embodiment of Fig. 15 relates to a fountain spout 41 in which a flow deflector 48 is located at the discharge opening 43 to provide a bell shaped fan 49. A lamphousing 44 accommodating a lamp (not shown) is located directly below the deflector and the interior walls of the liquid outlet and flow deflector of the region above the lamp housing 44 are reflective by a coating 46 and as a result the water departing the liquid outlet 41 serves as a light guide until the fan begins to break up at which point the light within the water becomes visible to produce a spectacular display.

The thirteenth embodiment of Fig. 16 relates to a fountain of the waterfall type whereby a sheet of descending water 50 is created by a dam 51 located to one side of a water reservoir 52. The dam is formed with apertures 53 on its inner face which permit the entry of the water into the interior of the dam and a discharge opening 54 at the upper end of its exterior face such that water flowing from within the dam merges with water flowing over the exterior surface of the dam to produce a non-turbulent stream of descending water 50. A lamp housing 55 is located adjacent the discharge opening 54 and is adapted to direct light emanating from the lamp to discharge opening 54. Due to the non-turbulent nature of the descending sheet of water for at least a significant portion of travel below the dam 50 the light is entrapped in that sheet of water and is released when the flow is rendered turbulent or strikes a surface to produce a spectacular display.

The fourteenth embodiment of Fig. 17 relates to the incorporation of a lamp housing 60 within a liquid outlet 61 connected to a hose 63, the interior walls of which said liquid outlet beyond the lamp housing 60 may be rendered reflective. The electrical cables for the lamp within the lamp housing 60 are accommodated within a flexible conduit 62 which extends through the hose 63 connected to the liquid outlet 61 to exit from the water conduit to which the hose is connected at some suitable location. As a result of the embodiment a hose-connected liquid outlet is produced which may be used to produce a spectacular display and/or to illuminate those items at which the water stream is being directed.

It should be appreciated that in the case of the embodiments of Figs. 13, 14, 15, 16, and 17 the lamp housing may be replaced by one end of a light guide extending from a remotely located light-supply to the discharge opening whereby the light-supply may be accommodated within the liquid stream at the remote location or separate from the liquid stream. The light guides described in relation to the embodiments of Figs. 5 to 12 may be used in the embodiments of Figs. 13 to 17.

In addition, in relation to each of the embodiments means may be provided for introducing a controlled stream of air or gas bubbles, or any particles as dye particles, fluorescent or not, or with other characteristics into the stream of water. As a result, the bubbles or particles would be illuminated within the jet stream to provide a spectacular display.

In addition the jet streams produced at the discharge opening of the embodiments may take any configuration.

Also, when a jet or stream of light-conducting liquid collides with a secondary jet or stream, which may or may not be light-conducting, turbulence at the side of impact of the jets may disturb the light-conducting properties of the primary jet, such that light may leave the primary jet, providing for a spectacular display. This effect is particular suitable in case of a light-conducting sheet of water that is hit by one or more secondary jets.

It should appreciated that the scope of the invention needs not to be limited to the particular scope of the embodiments described above. For instance, the invention, as realised in a particular embodiment, may be used in beverage dispensers and cooling processes, where clear liquids are or can be used (e.g. a lathe, in cutting, grinding, polishing-processes), and light may be projected along with the cooling liquid to facilitate inspection. In addition, light of any wave length or color may be used in each of the embodiments discussed.

Claims

1. An arrangement comprising a lightsource (17-19, 30-31, 44-45, 55, 60, 101-102, 107), and a liquid outlet (15, 28, 41, 51, 61), said liquid outlet having a supply opening, which said supply

opening can be connected to a pressurised source of liquid, the liquid having light conducting properties, and a discharge opening (16, 29, 43, 54, 103), which said discharge opening produces a stream of said liquid when said supply opening is connected to said pressurised source of liquid, characterised in that: said discharge opening produces a non-turbulent or low-turbulent stream of said liquid, and that said lightsource is arranged inside said liquid outlet adjacent to said discharge opening.

2. An arrangement according to claim 1, characterised in that said lightsource is comprised by one end of a lightguide (23a, 23-23b, 25, 25a, 36, 39, 46), the other end of which said lightguide is optically coupled to a remote lightsupply (17, 18).

3. An arrangement according to claim 1 or 2, characterised in that said lightsource is in heat exchange relationship with the liquid passing through said liquid outlet.

4. An arrangement according to claims 2 or 3, characterised in that said lightguide is flexible and comprises a glassfibre lightguide, a synthetic fiber lightguide, or a fluid-filled lightguide.

5. An arrangement according to one of the preceding claims, characterised in that said lightguide comprises a length of transparent rod-shaped material having a refractive index greater than the refractive index of said liquid.

6. An arrangement according to one of the preceding claims, characterised in that said lightguide is accommodated within a channel (26, 38), which is sealed from the entry of said liquid.

7. An arrangement according to one of the preceding claims, characterised in that said light guide comprises the inner walls of the liquid outlet which are substantially smooth and reflective.

8. An arrangement according to one of the preceding claims, characterised in that the inner walls of the liquid outlet are covered with a transparent material having an index of refraction smaller than the index of refraction of said liquid passing through said liquid outlet to the discharge opening.

9. An arrangement according to one of the preceding claims, characterised in that the walls of at least a portion of said liquid outlet in the region of said discharge opening are transparent.

10. An arrangement according to one of the preceding claims, characterised in that said light guide comprises a transparent tube (23, 39), extending through said liquid outlet which said tube conducts said liquid for at least a portion of its passage through said liquid outlet, the external surface of said tube being spaced from the internal walls of said liquid outlet, and the gap there between containing a transparent medium having a refractive index less than the refractive index of the material of said tube.

11. An arrangement according to one of the preceding claims, characterised in that said light source comprises a lamp (18, 31, 45, 107) accommodated within a holder (17, 30, 44, 101) the side of said holder, directed at said discharge opening, comprises a window (19, 102) having the optical effect of a converging lens.

12. An arrangement according to claim 11, characterised in that said holder is hydro-dynamically shaped to minimize turbulance which may be created in said liquid by said holder.

13. An arrangement according to one of the preceding claims, characterised in that a reflective surface (34, 37, 37a, 46) is interposed in the passage of light from said light source to said discharge opening.

14. An arrangement according to one of the claims 2 to 10, characterised in that said end of said light guide acting as said light source is hydro-dynamically shaped and serves as a convergent lens.

15. An arrangement according to one of the preceding claims, characterised in that said light source comprises a lamp accommodated within a holder, the interior of said holder being connected to the atmosphere by means of a tube (35, 47, 62), which may also support electrical cables for said lamp.

16. An arrangement according to one of the preceding claims, characterised in that the discharge opening is a fountain nozzle.

17. An arrangement according to one of claims 1 to 15, characterised in that said liquid outlet comprises a waterfaucet, a watertap or a waterspout.

18. An arrangement according to one of claims 1 to 15, characterised in that said liquid outlet comprises a spout mounted to the end of a flexible tube or hose.

19. An arrangement according to claim 16, characterised in that said discharge opening has mounted therein a flow deflector whereby a fan-shaped stream of said liquid issues from said discharge opening.

20. An arrangement according to one of claims 1 to 15, characterised in that said liquid outlet comprises a dam (51).

21. An arrangement according to one of the preceding claims, characterised in that said discharge opening produces a stream of said liquid having an elongated cross-section.

22. An arrangement according to one of the preceding claims, characterised in that gas bubbles are introduced in said liquid.

23. An arrangement as claimed in one of the preceding claims, characterised in that particles of any kind or colour are introduced into said liquid.

24. An arrangement according to one of the preceding claims, characterised in that the light from said light source is coloured.

25. An arrangement according to one of the preceding claims, characterised in that one or more prisms or optical grids are placed between said light source and said discharge opening.

26. An arrangement according to one of the preceding claims, characterised in that one or more color filters are placed between said light source and said discharge opening.

27. An arrangement according to one of the

preceding claims, characterised in that said liquid is water.

28. An arrangement according to one of claims 1 to 26, characterised in that said liquid is a beverage.

29. An arrangement according to one of claims 1 to 26, characterised in that said liquid is a cooling liquid.

30. An arrangement according to one of the preceding claims, characterised in that said light source is activated by a switch sensitive to the flow of said liquid through or to said liquid outlet.

Patentansprüche

1. Eine Vorrichtung, die eine Lichtquelle (17-19, 30-31, 44-45, 55, 60, 101-102, 107) und eine Flüssigkeitsdüse (15, 28, 41, 51, 61) enthält, welche besagte Flüssigkeitsdüse eine Zufuhröffnung hat, welche besagte Zufuhröffnung an eine preßflüssigkeitsquelle angeschlossen werden kann, welche Flüssigkeit lichtleitende Eigenschaften hat, und eine Abflußöffnung (16, 19, 43, 54, 103), welche besagte Abflußöffnung einen Strom besagter Flüssigkeit erzeugt wenn besagte Zufuhröffnung auf Preßflüssigkeitsquelle angeschlossen ist, dadurch gekennzeichnet, daß besagte Abflußöffnung einen nicht-turbulenten oder schwach-turbulenten Strom besagter Flüssigkeit erzeugt und daß besagte Lichtquelle innerhalb besagter Flüssigkeitsdüse an besagte Abflußöffnung angrenzend eingerichtet ist.

2. Eine Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß besagte Lichtquelle in einem Ende eines Lichtleiters (23a, 23-23b, 25a, 36, 39, 46) enthalten ist; das andere Ende des besagten Lichtleiters ist optisch an eine entfernte Lichtzufuhr (17, 18) gekoppelt.

3. Eine Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß besagte Lichtquelle in einer Wärmeaustauschwirkung zu der Flüssigkeit, die durch besagte Flüssigkeitsdüse läuft, steht.

4. Eine Vorrichtung nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß besagter Lichtleiter flexibel ist und einen Glasfiber-Lichtleiter, einen synthetischen Fiberlichtleiter oder einen mit Flüssigkeit gefüllten Lichtleiter enthält.

5. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagter Lichtleiter eine Einheit transparentes Stabförmiges Material mit einem höheren Refraktionsindex als dem Refraktionsindex besagter Flüssigkeit enthält.

6. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagter Lichtleiter in einer Leitung (26, 38) welche gegen das Eindringen besagter Flüssigkeit abgedichtet ist, untergebracht ist.

7. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagter Lichtleiter die Innenwände der Flüssigkeitsdüse enthält, welche sehr glatt und reflektierend sind.

8. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß die Innenwände der Flüssigkeitsdüse bedekt sind mit einem transparenten Material mit einem geringeren Refraktionsindex als dem Refraktionsindex besagter Flüssigkeit, die durch besagte Flüssigkeitsdüse zu der Abfuhröffnung strömt.

9. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß die Wände von wenigstens einem Teil der besagten Flüssigkeitsdüse im Gebiet der besagten Abflußöffnung transparent sind.

10. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagter Lichtleiter ein transparentes Rohr (23, 39) enthält, das sich in der besagten Flüssigkeitsdüse ausstreckt, welches besagte Rohr besagte Flüssigkeit zu wenigstens einem Teil ihres Laufes durch besagte Flüssigkeitsdüse leitet; zwischen Außenwand des besagten Rohres und besagter Flüssigkeitsdüse befindet sich ein Zwischenraum und dieser Raum enthält ein transparentes Medium mit einem geringeren Refraktionsindex als dem Refraktionsindex des Materials von besagtem Rohr.

11. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagte Lichtquelle eine Lampe (18, 31, 45, 107) enthält, in einem Halter (17, 30, 44, 101) untergebracht. Die Seite des besagten Halters, gerichtet auf die Abflußöffnung, enthält ein Fenster (19, 102) mit dem optischen Effekt einer konvergierenden Linse.

12. Eine Vorrichtung nach Anspruch 11, dadurch gekennzeichnet, daß besagter Halter hydro-dynamisch geformt ist um Turbulenz, die in der besagten Flüssigkeit durch besagten Halter erzeugt werden kann, zu minimalisieren.

13. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß eine reflektierende Fläche (34, 37, 37a, 46) im Lichtstrom zwischen besagter Lichtquelle und besagter Abflußöffnung angebracht ist.

14. Eine Vorrichtung nach einem der Ansprüche 2 bis 10, dadurch gekennzeichnet, daß besagtes Ende von besagtem Lichtleiter fungierend als besagte Lichtquelle hydro-dynamisch geformt ist und als konvergierende Linse dient.

15. Eine Vorrichting, nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagte Lichtquelle eine Lampe, untergebracht in einem Halter, enthält. Das Innere des besagten Halters wird mittels eines Rohres (35,47,62), das auch Stromkabel für besagte Lampe fassen kann, mit der Atmosphäre verbunden.

16. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß die Abflußöffnung eine Springbrunnendüse ist.

17. Eine Vorrichtung nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß besagte Flüssigkeitsdüse einen Zapfhahn, einen Wasserhahn oder einen Auslauf enthält.

18. Eine Vorrichtung nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß besagte Flüssigkeitsdüse eine Strahldüse, ange-

bracht am Ende eines flexibelen Rohres oder Schlauches, enthält.

19. Eine Vorrichtung nach Anspruch 16, dadurch gekennzeichnet, daß in besagter Abflußöffnung ein Flußdeflektor angebracht ist, wodurch ein fächerartiger Strom besagter Flüssigkeit aus besagter Abflußöffnung strömt.

20. Eine Vorrichtung nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß besagte Flüssigkeitsdüse einen Damm enthält.

21. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagte Abflußöffnung einen Strom besagter Flüssigkeit mit einem längeförmigen Querdurchschnitt erzeugt.

22. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß Gasblasen in besagte Flüssigkeit eingeführt werden.

23. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß Partikel irgendeiner Art oder Farbe in besagte Flüssigkeit eingeführt werden.

24. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß das Licht aus besagter Lichtquelle Farbe hat.

25. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß ein oder mehr Prismen oder optische Gitter zwischen besagter Lichtquelle und besagter Abflußöffnung angebracht sind.

26. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß ein oder mehr Farbfilter zwischen besagter Lichtquelle und besagter Abflußöffnung angebracht sind.

27. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagte Flüssigkeit Wasser ist.

28. Eine Vorrichtung nach einem der Ansprüche 1 bis 26, dadurch gekennzeichnet, daß besagte Flüssigkeit ein Getränk ist.

29. Eine Vorrichtung nach einem der Ansprüche 1 bis 26, dadurch gekennzeichnet, daß besagte Flüssigkeit eine kühlende Flüssigkeit ist.

30. Eine Vorrichtung nach einem der vorigen Ansprüche, dadurch gekennzeichnet, daß besagte Lichtquelle durch einen Schalter aktiviert wird, der auf den Strom besagter Flüssigkeit durch die oder zu der Flüssigkeitsdüse reagiert.

Revendications

1. Un dispositif comprenant une source lumineuse (17-19, 30-31, 44-45, 55, 60, 101-102, 107) et une sortie de liquide (15, 28, 41, 51, 61), ladite sortie de liquide ayant un orifice d'alimentation qui peut être mis en contact avec une source de liquide sous pression, ce liquide ayant des propriétés conductrices de lumière, et un orifice de vidange (16, 29, 43, 54, 103) qui produit un courant dudit liquide lorsque ledit orifice d'alimentation se trouve associé à ladite source de liquide sous pression, caractérisé en ce que: ledit orifice de vidange produit un courant non-turbulent ou faiblement turbulent dudit liquide et ladite source lumineuse se trouve disposée à l'intérieur de ladite sortie de liquide, jointe audit orifice de vidange.

2. Un dispositif conforme avec la revendication 1, caractérisé en ce que ladite source lumineuse comprend une extrémité d'un conduit lumineux (23a, 23-23b, 25, 25a, 36, 39, 46), l'autre extrémité dudit conduit lumineux se trouve optiquement associée à une alimentation lumineuse émise à distance (17, 18).

3. Un dispositif conforme avec les revendications 1 ou 2, caractérisé en ce que ladite source lumineuse se trouve en relation d'échange de chaleur avec le liquide qui passe à travers ladite sortie de liquide.

4. Un dispositif conforme avec les revendications 2 ou 3, caractérisé en ce que ledit conduit lumineux est souple et comprend un conduit lumineux en fibre de verre, un conduit lumineux en fibre synthétique, ou, un conduit lumineux rempli par un fluide.

5. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que ledit conduit lumineux comprend une pièce de matériau transparent en forme de barre possédant un indice de réfraction plus élevé que l'indice de réfraction dudit liquide.

6. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que ledit conduit lumineux se trouve, ajusté à l'intérieur d'un conduit (26, 38) qui est, lui-même fermé à l'entrée dudit liquide.

7. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que ledit conduit lumineux comprend les parois intérieures de la sortie de liquide et que celles-ci sont substantiellement lisses et réfléchissantes.

8. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que les parois intérieures de la sortie de liquide sont revêtues d'un matériau transparent possédant un indice de réfraction plus bas que l'indice de réfraction dudit liquide à travers ladite sortie de liquide à l'orifice de vidange.

9. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que les parois d'au moins une partie de ladite sortie de liquide dans la zone dudit orifice de vidange sont transparentes.

10. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que ledit conduit lumineux comprend un tube transparent (23, 29), se prolongeant à travers ladite sortie de liquide et qui conduit ledit liquide au moins partiellement à son passage au travers de ladite sortie de liquide, la superficie extérieure dudit tube étant espacée des parois intérieures de ladite sortie de liquide, et l'espace formé entre celles-ci contenant une matière transparente possédant un indice de réfraction inférieur à l'indice de réfraction du matériau dudit tube.

11. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que ladite source lumineuse comprend une lampe (18, 31, 45, 107) installée à l'intérieur d'un réceptacle

(17, 30, 44, 101), le côté dudit réceptacle, dirigé vers ledit orifice de vidange, comprenant une vitre (19, 102) ayant l'effet optique d'une lentille convergente.

12. Un dispositif conforme avec la revendication 11, caractérisé en ce que ledit réceptacle a été façonné par des moyens hydrodynamiques afin de minimiser toute éventuelle turbulence qui puisse être causée dans ledit liquide par ledit réceptacle.

13. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce qu'une surface réfléchissante (34, 37, 37a, 46) a été interposée dans le passage de la lumière de ladite source lumineuse audit orifice de vidange.

14. Un dispositif conforme avec l'une des revendications allant des numéros 2 à 10, caractérisé en ce que ladite extrémité dudit conduit lumineux agissant comme ladite source lumineuse, a été façonnée par des moyens hydrodynamiques et a la fonction de lentille convergente.

15. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que ladite source lumineuse comprend une lampe ajustée à l'intérieur d'un réceptacle, l'intérieur dudit réceptacle ayant été mis en contact avec l'atmosphère par l'intermédiaire d'un tube (35, 47, 62) lequel peut aussi porter des cables électriques pour ladite lampe.

16. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que l'orifice de vidange est un bec provoquant un jet d'eau sous forme de fontaine.

17. Un dispositif conforme avec l'une des revendications allant des numéros 1 à 15, caractérisé en ce que ladite sortie de liquide comprend un bec d'eau, un robinet d'eau, ou, un tuyau de descente d'eau.

18. Un dispositif conforme avec l'une des revendications allant des numéros 1 à 15, caractérisé en ce que ladite sortie de liquide comprend un bec d'eau installé à l'extrémité d'un tube flexible ou d'un tuyau souple.

19. Un dispositif conforme avec la revendication 16, caractérisé en ce que ledit orifice de vidange est pourvu d'un dispositif déflecteur mis en place, et grâce auquel un jet dudit liquide en forme d'éventail sort dudit orifice de vidange.

20. Un dispositif conforme avec l'une des revendications allant des numéros 1 à 15, caractérisé en ce que ladite sortie de liquide comprend une retenue d'eau (51).

21. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que ledit orifice de vidange produit un jet dudit liquide ayant une section transversale allongée.

22. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que des bulles de gaz sont introduites dans ledit liquide.

23. Un dispositif comme revendiqué dans l'une des revendications précédentes, caractérisé en ce que des particules de toutes sortes et de toutes les couleurs sont introduites dans ledit liquide.

24. Un dispositif conforme avec l'une des revendications précédentes, caractérisé en ce que la lumière de ladite source lumineuse est colorée.

25. Un dispositif conforme avec l'une des revendications précédentes caractérisé en ce qu'un ou plusieurs prismes ou grilles optiques sont placés entre ladite source lumineuse et ledit orifice de vidange.

26. Un dispositif conforme avec l'une des revendications précédentes caractérisé en ce qu'un ou plusieurs filtres colorés sont placés entre ladite source lumineuse et ledit orifice de vidange.

27. Un dispositif conforme avec l'une des revendications précédentes caractérisé en ce que ledit liquide est de l'eau.

28. Un dispositif conforme avec l'une des revendications allant des numéros 1 à 26 caractérisé en ce que ledit liquide est une boisson.

29. Un dispositif conforme avec l'une des revendications allant des numéros 1 à 26, caractérisé en ce que ledit liquide est un liquide refroidissant.

30 Un dispositif conforme avec l'une des revendications précédentes caractérisé en ce que ladite source lumineuse est actionnée par un interrupteur sensible à la circulation dudit liquide à travers ou vers ladite sortie de liquide.

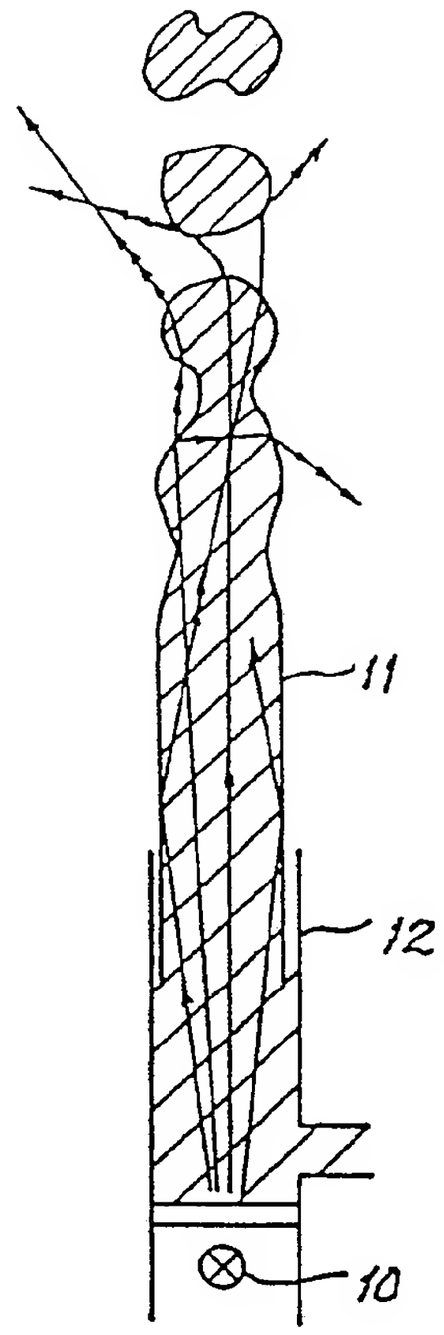

Fig. 1

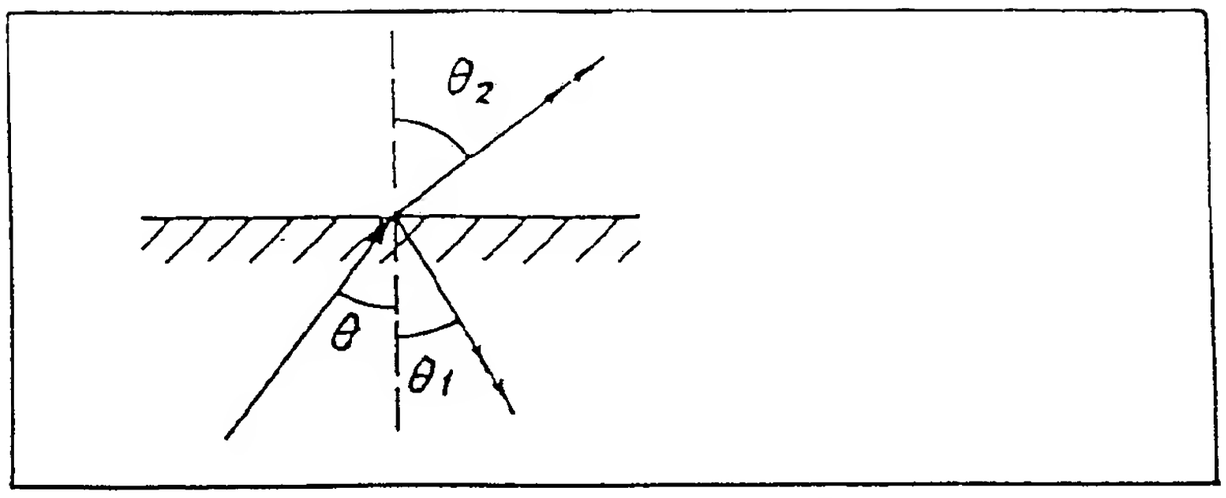

Fig. 2A

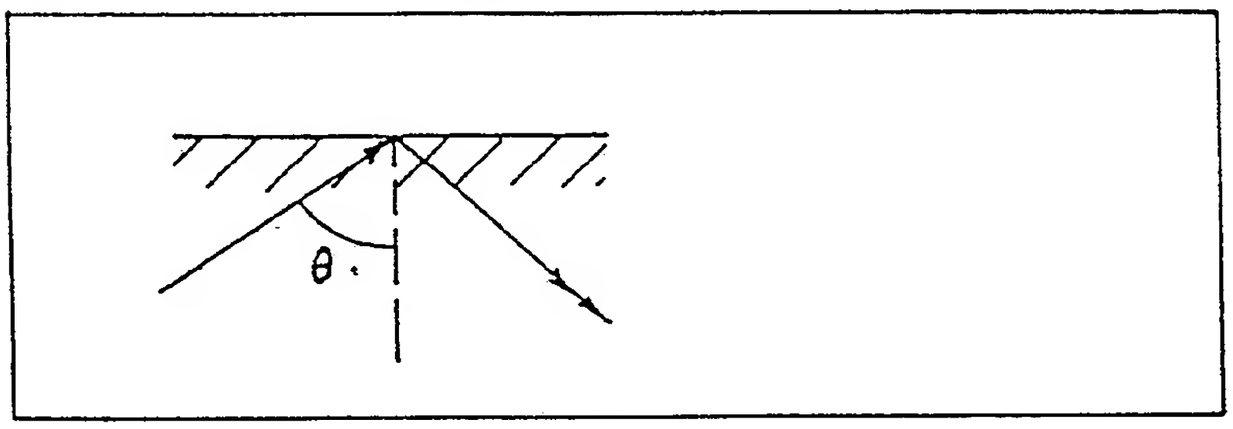

Fig. 2B

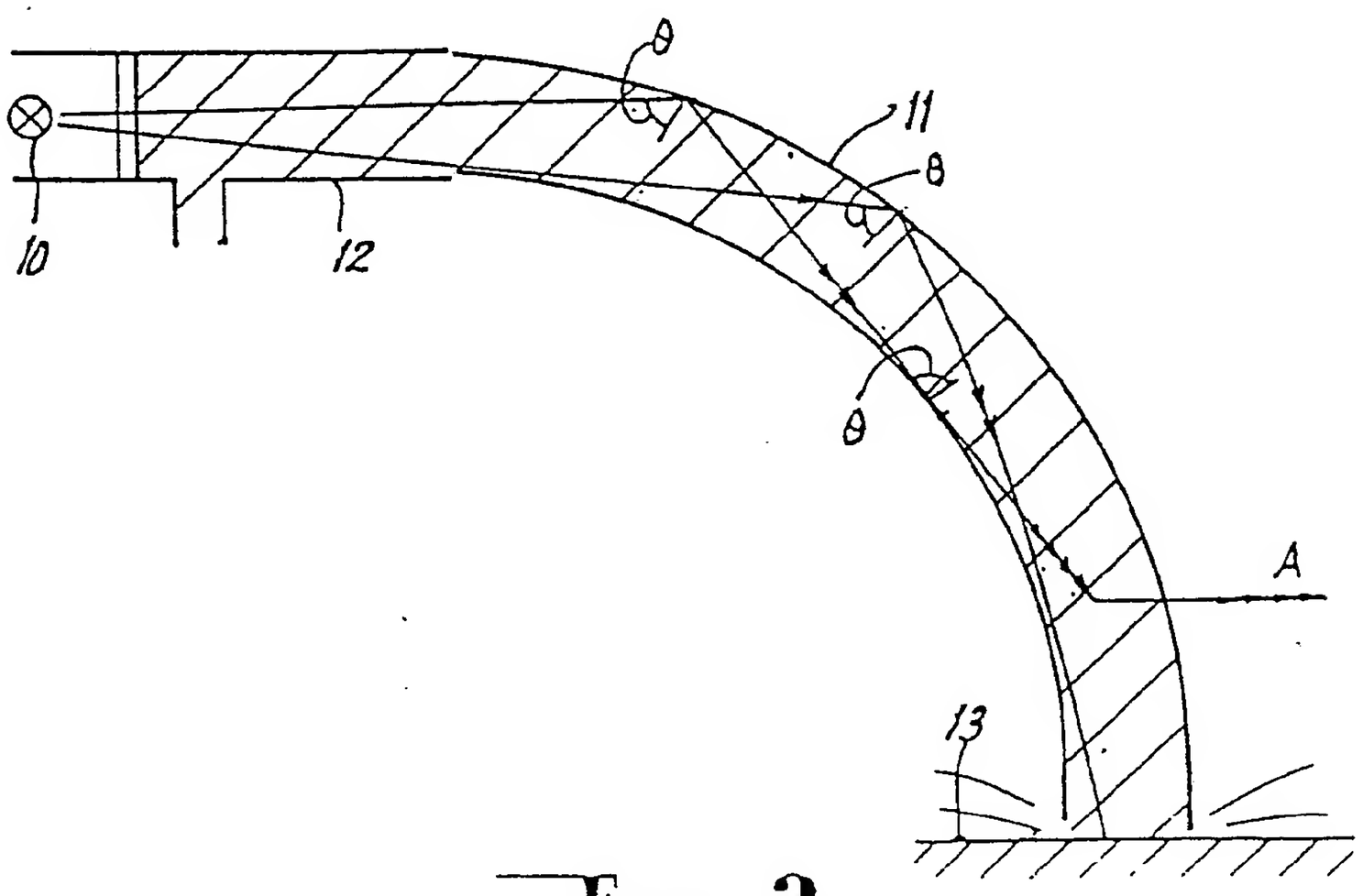

Fig. 3

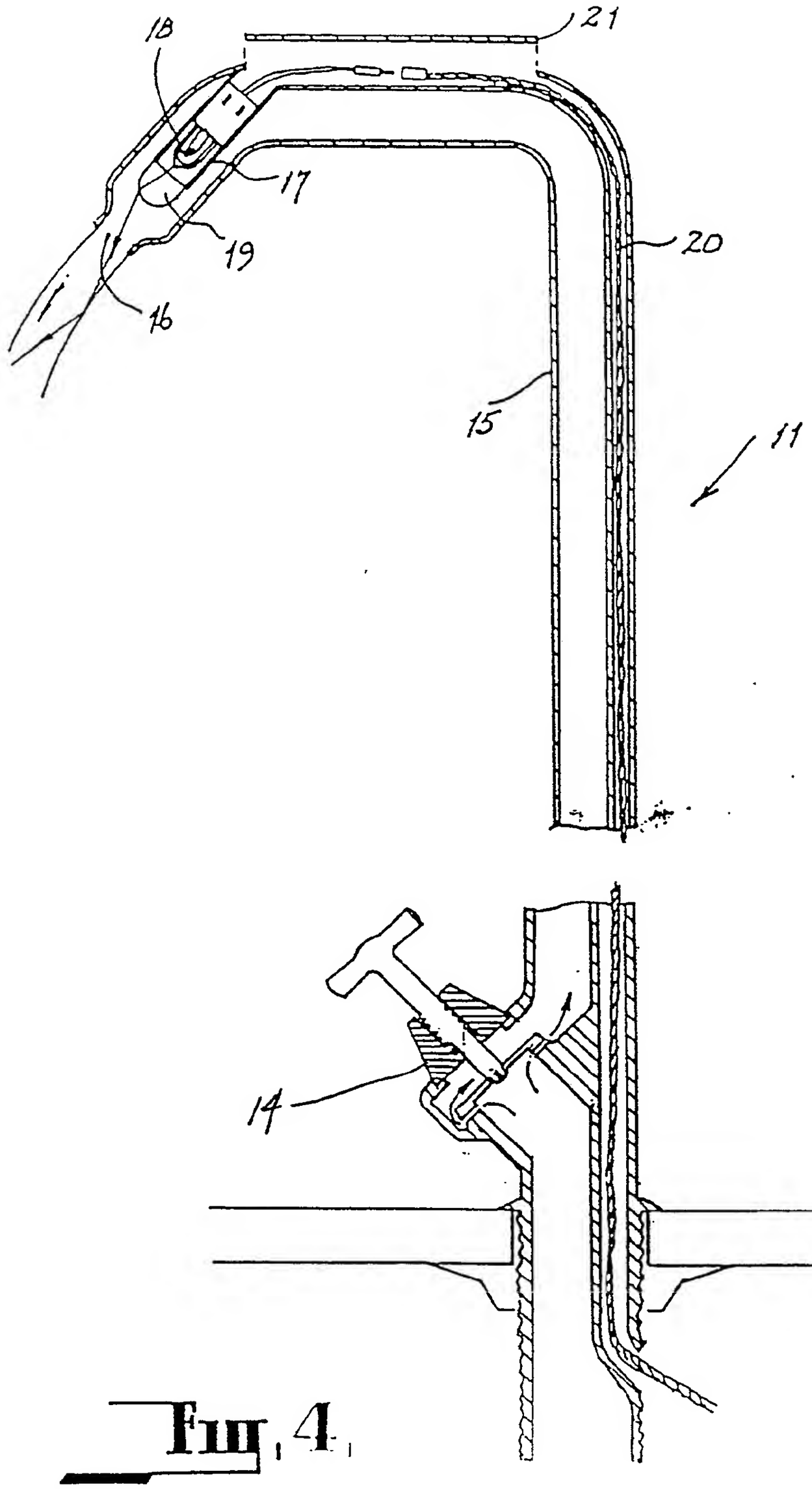

Fig. 4

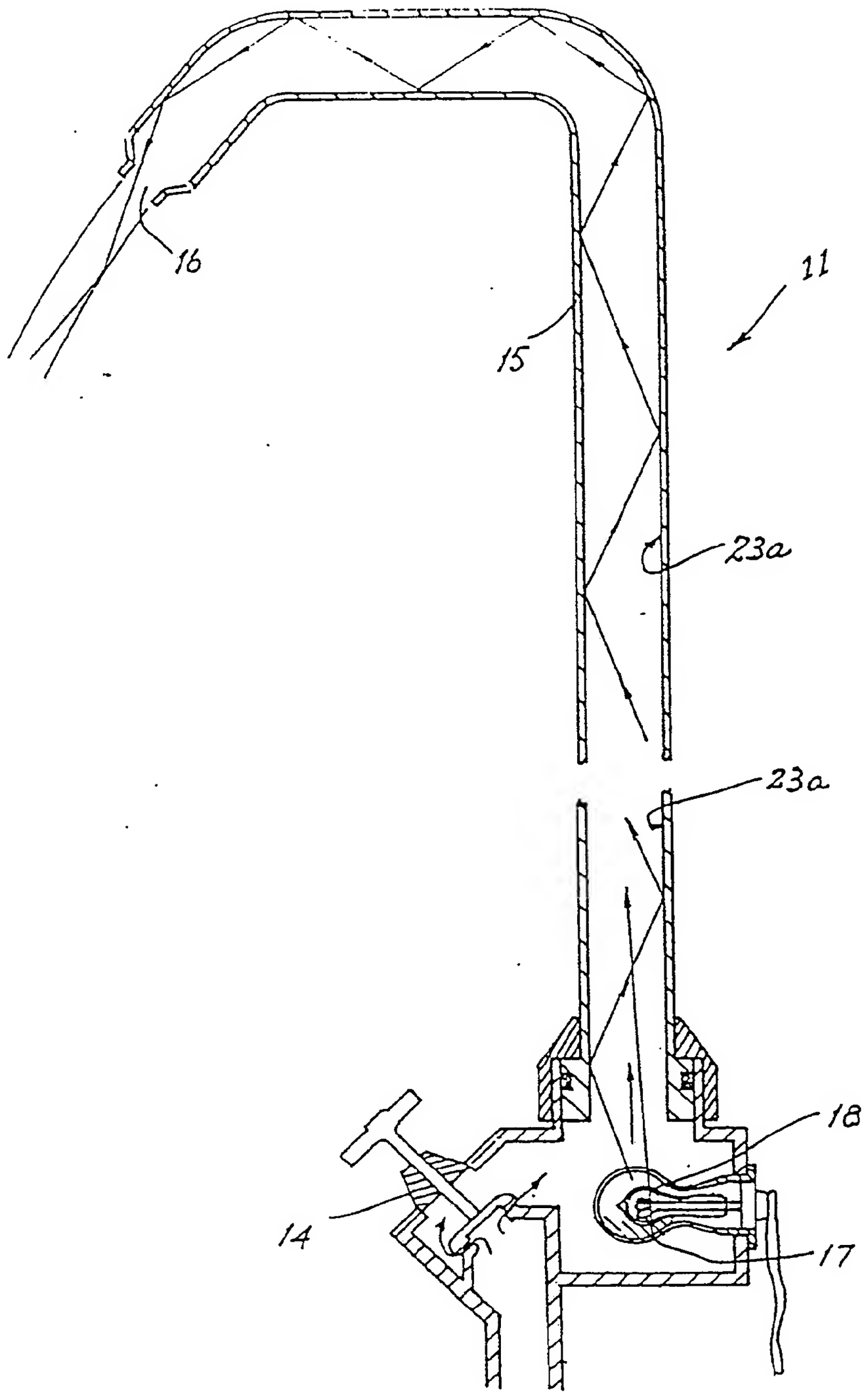

Fig. 5

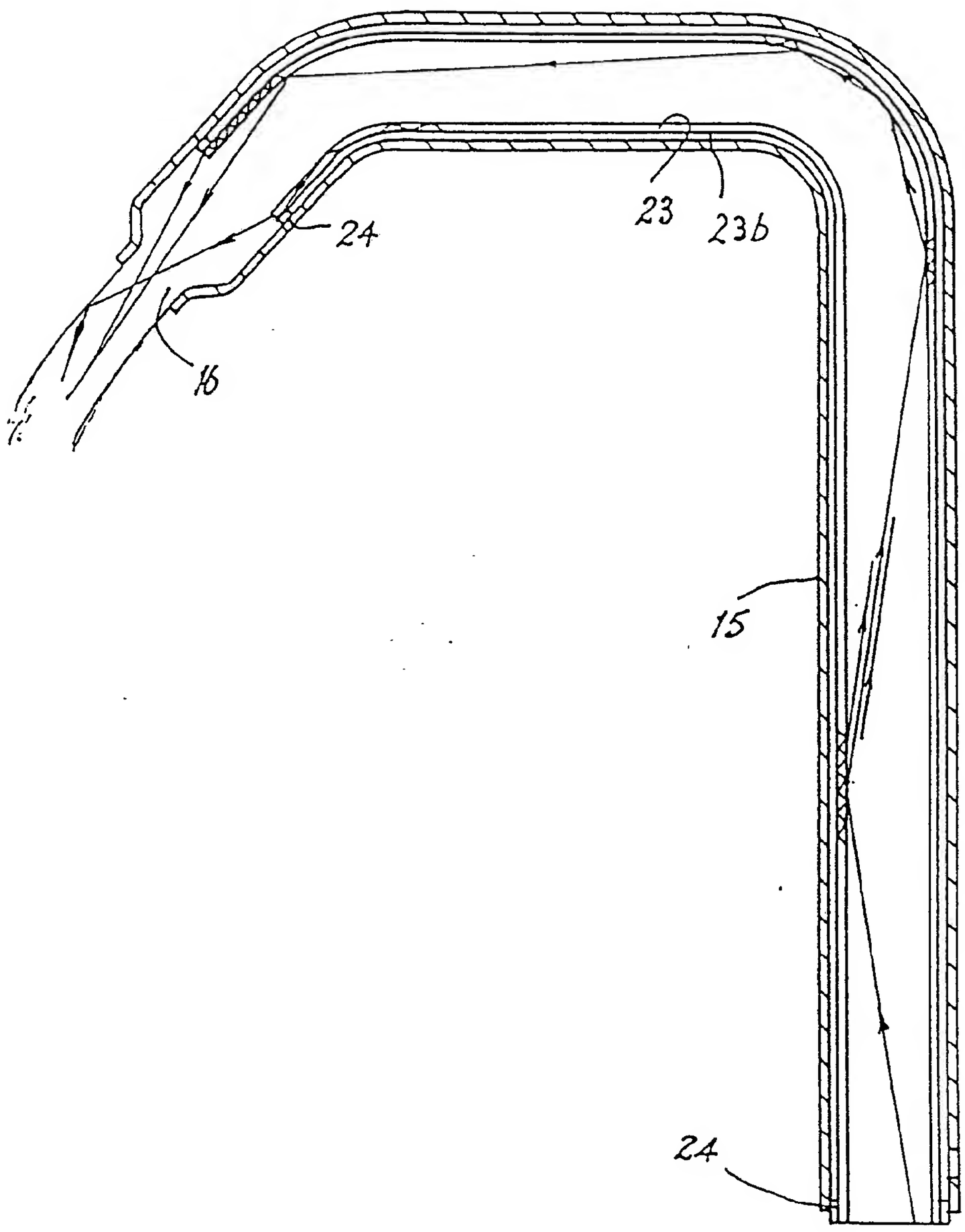

Fig. 6

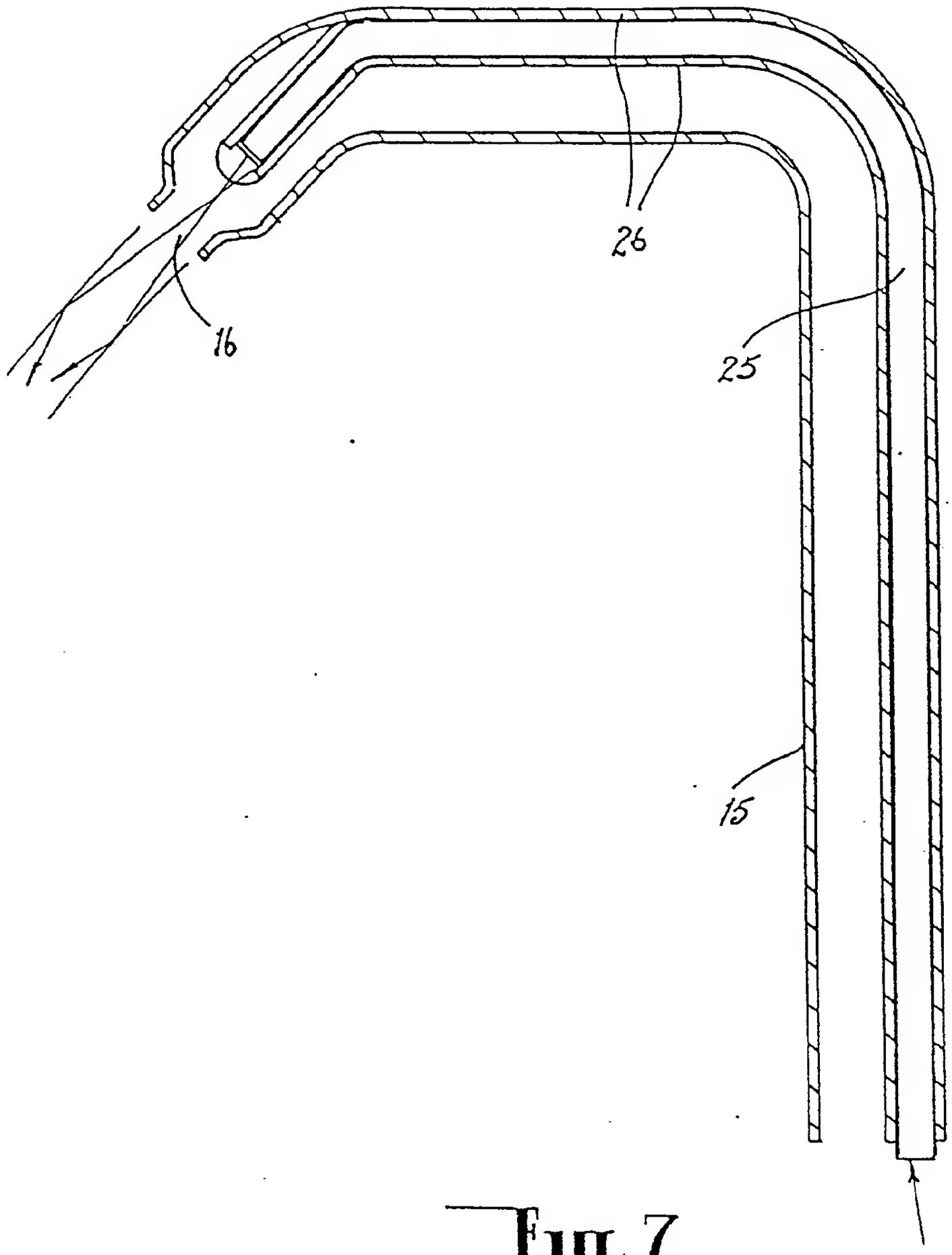

Fig. 7.

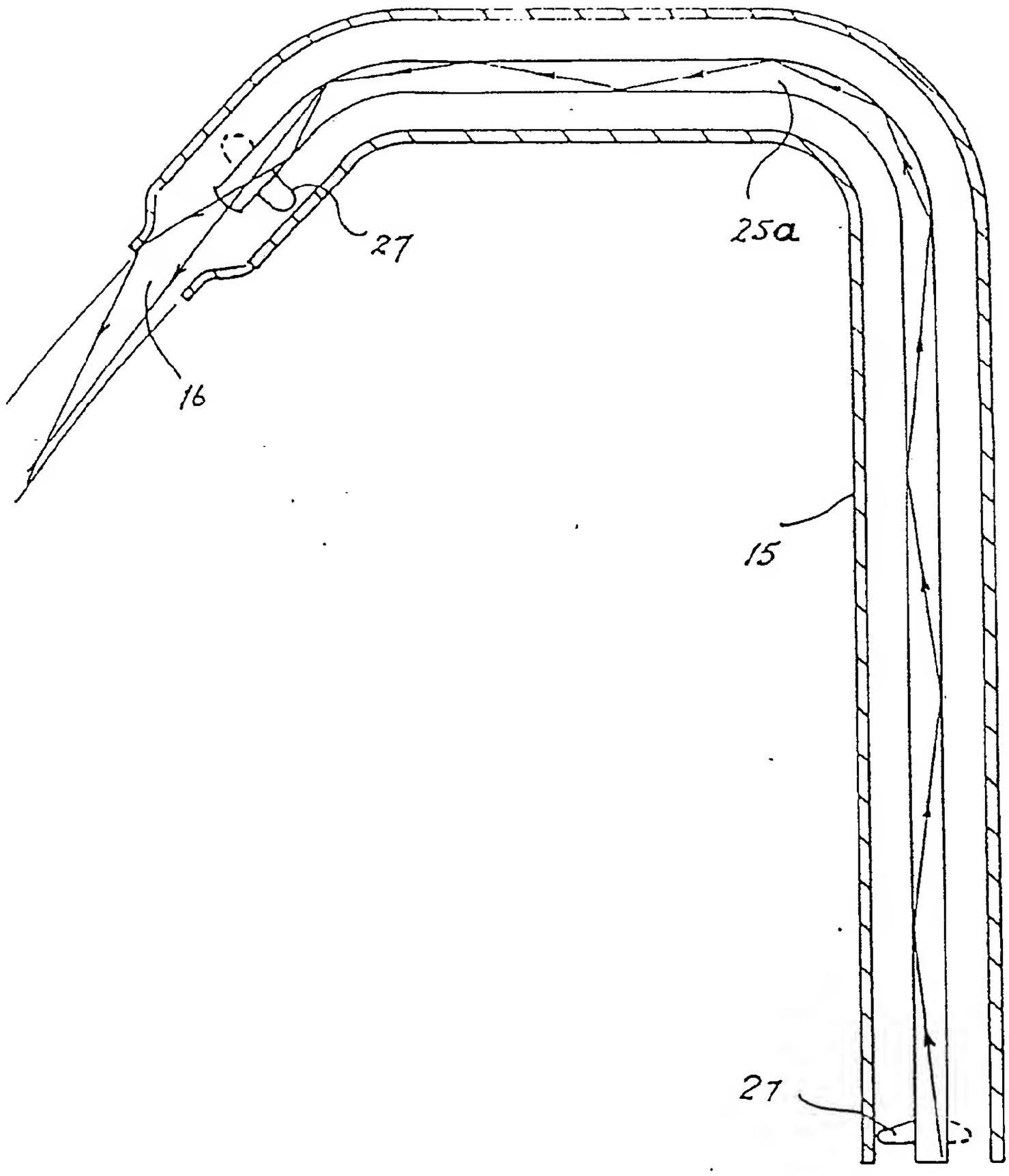

Fig. 8

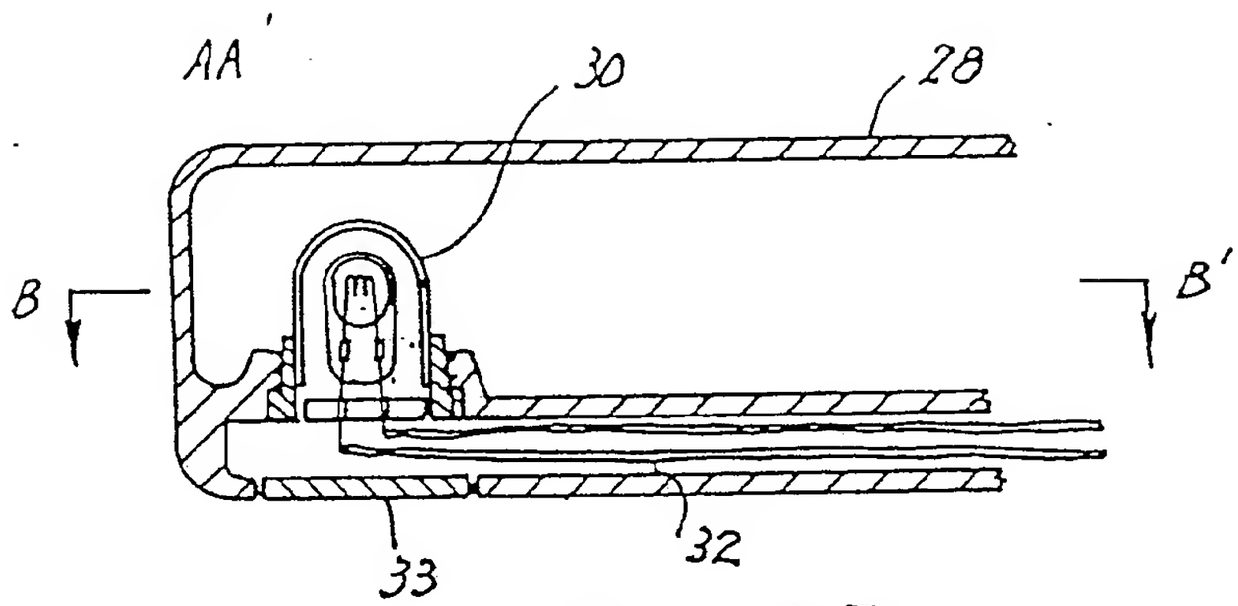

Fig. 9A.

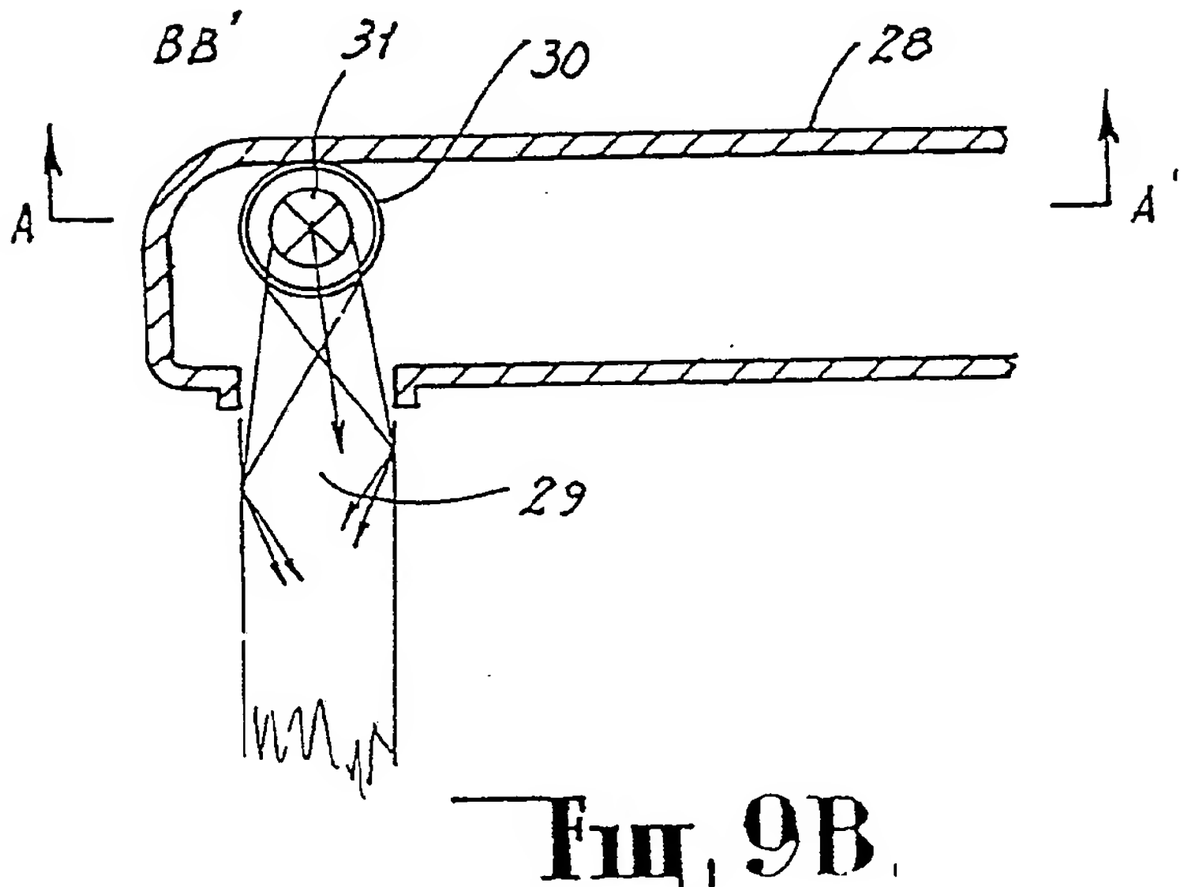

Fig. 9B.

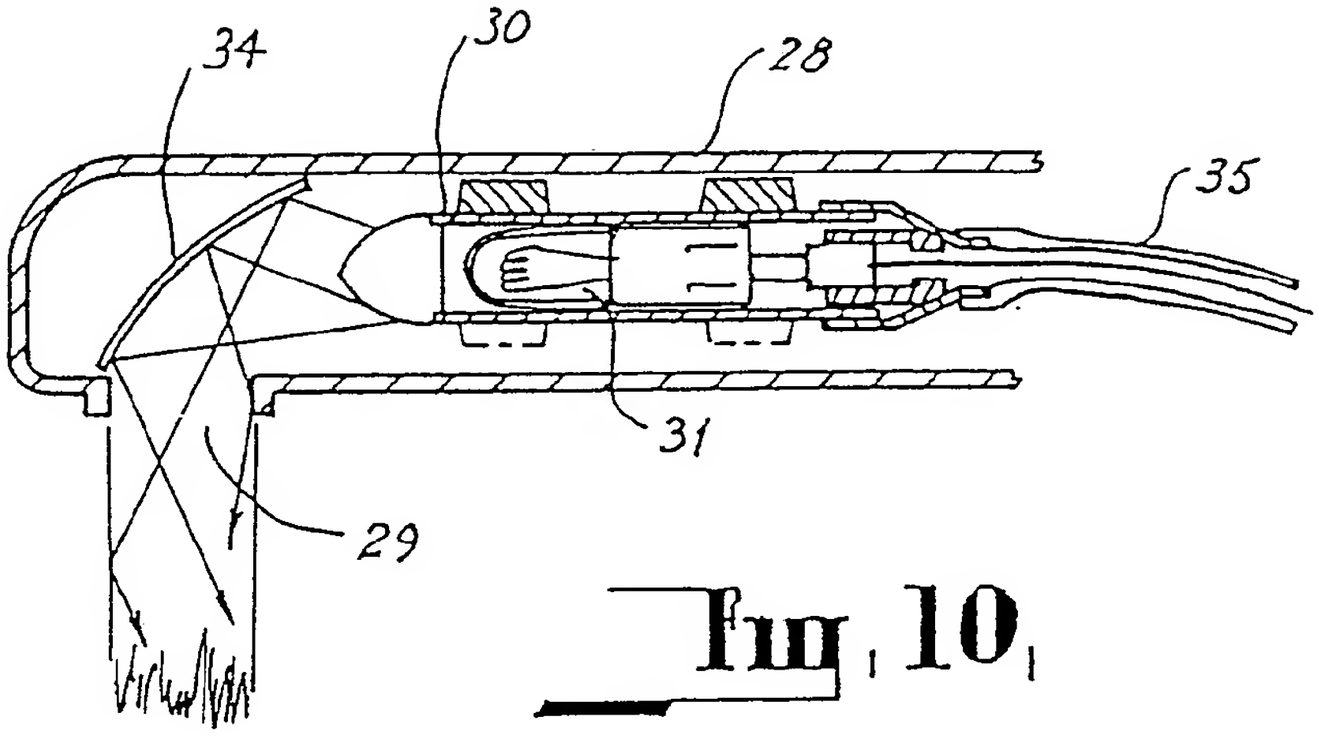

Fig. 10

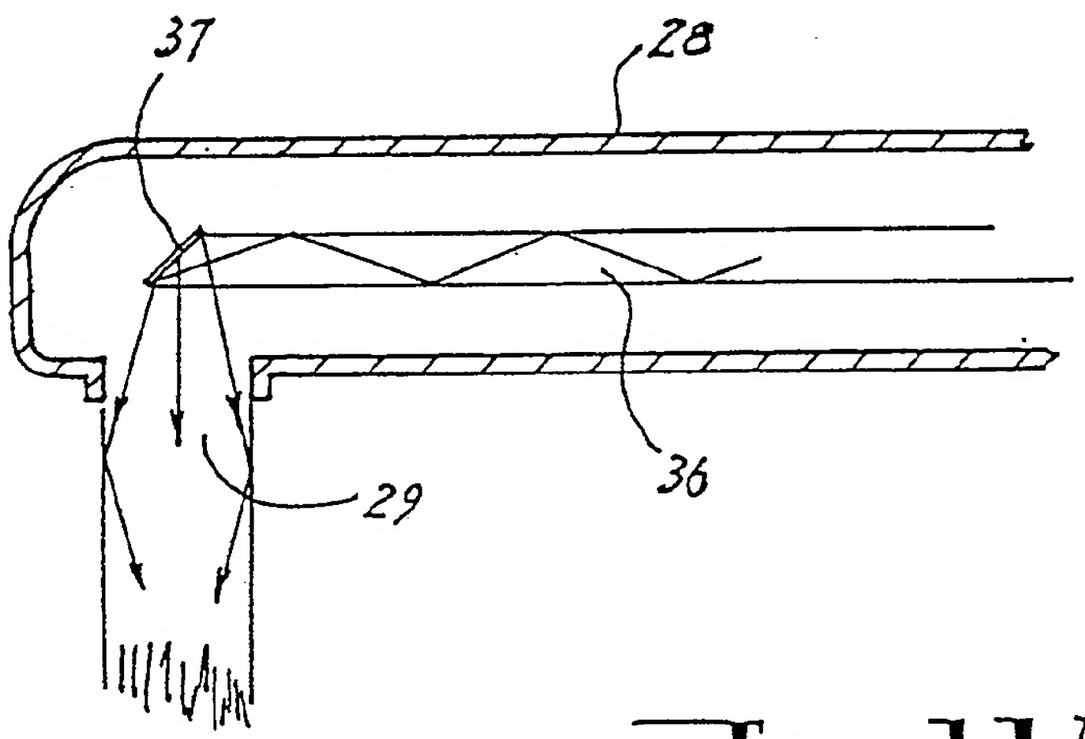

Fig. 11A

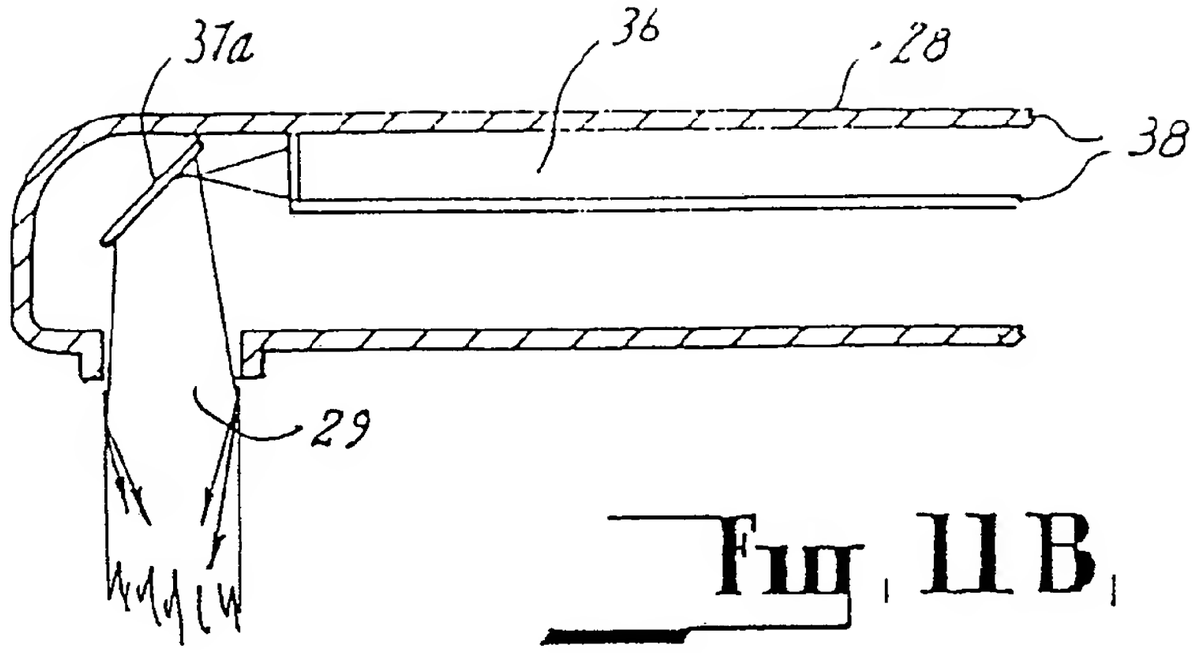

Fig. 11B

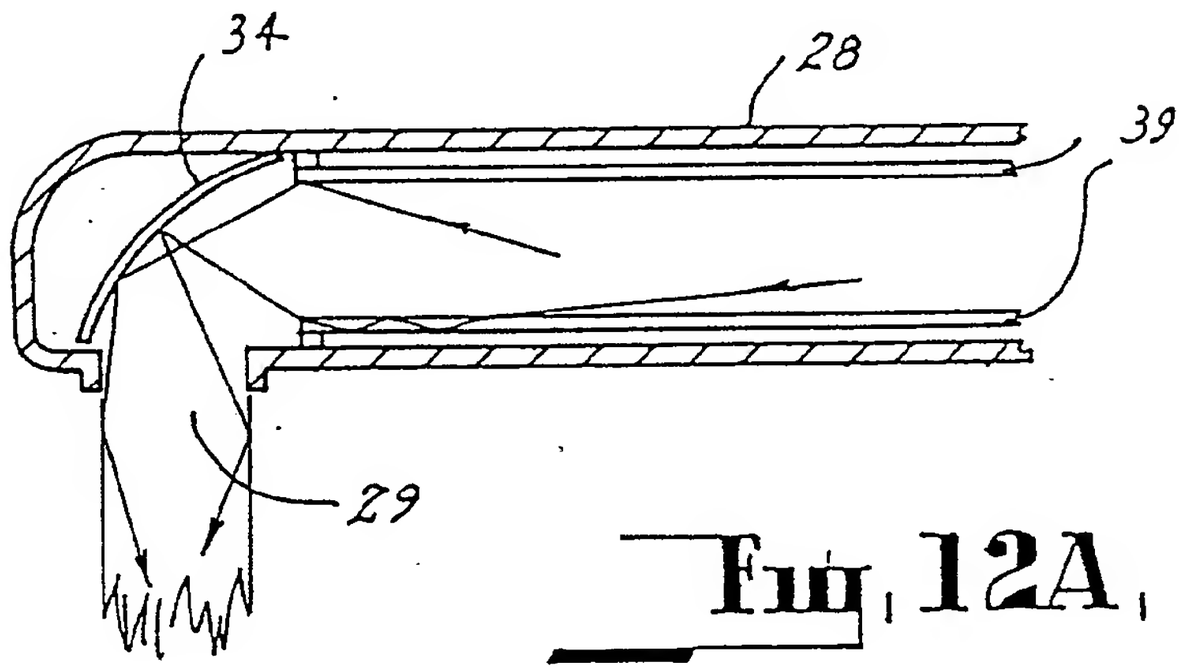

Fig. 12A

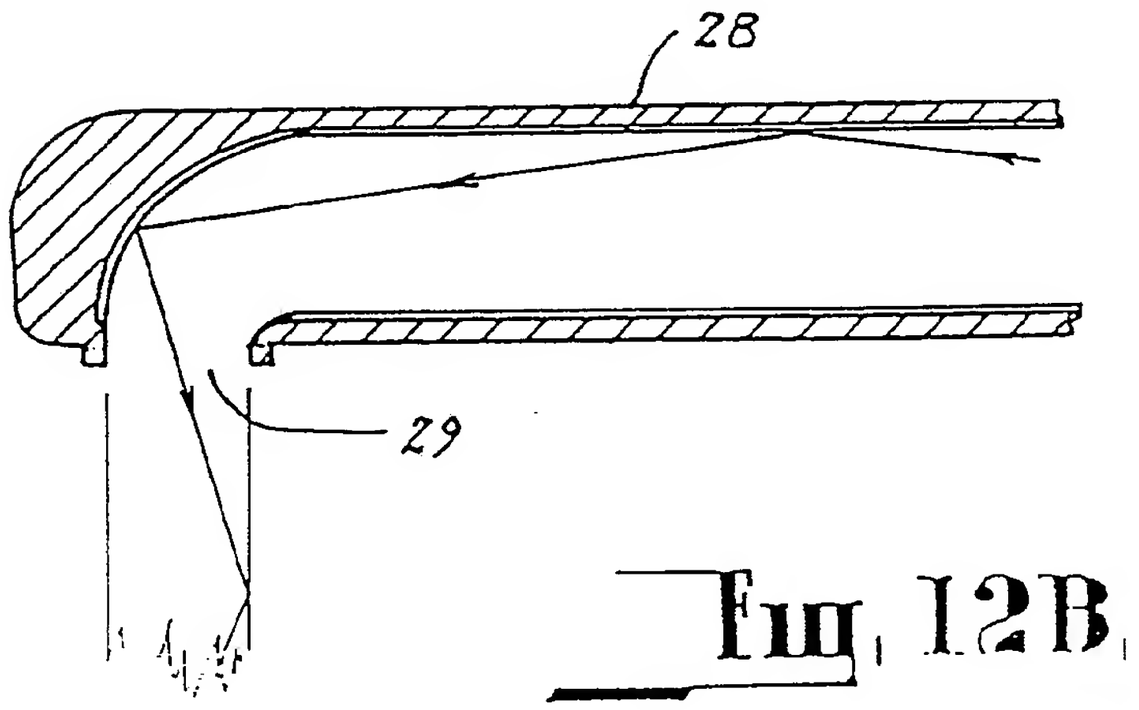

Fig. 12B

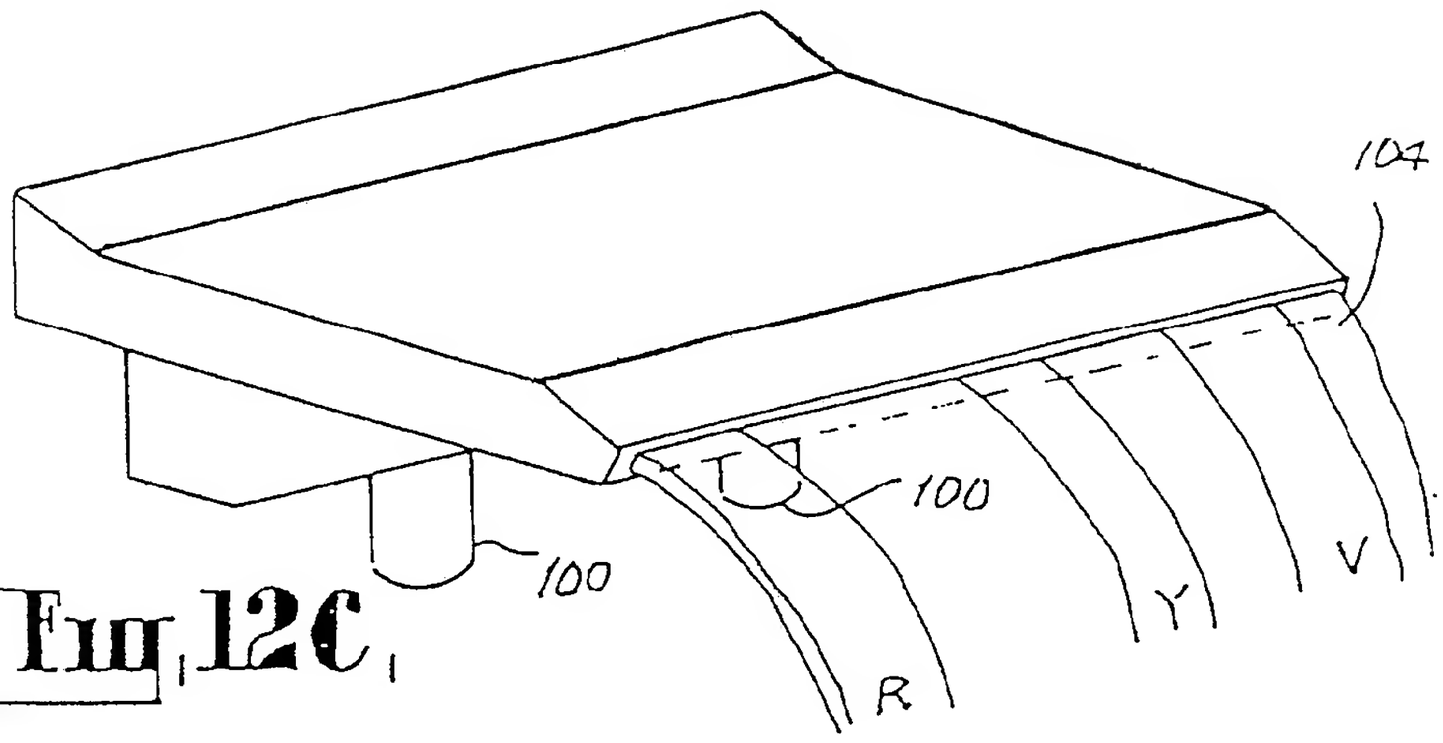

Fig. 12C

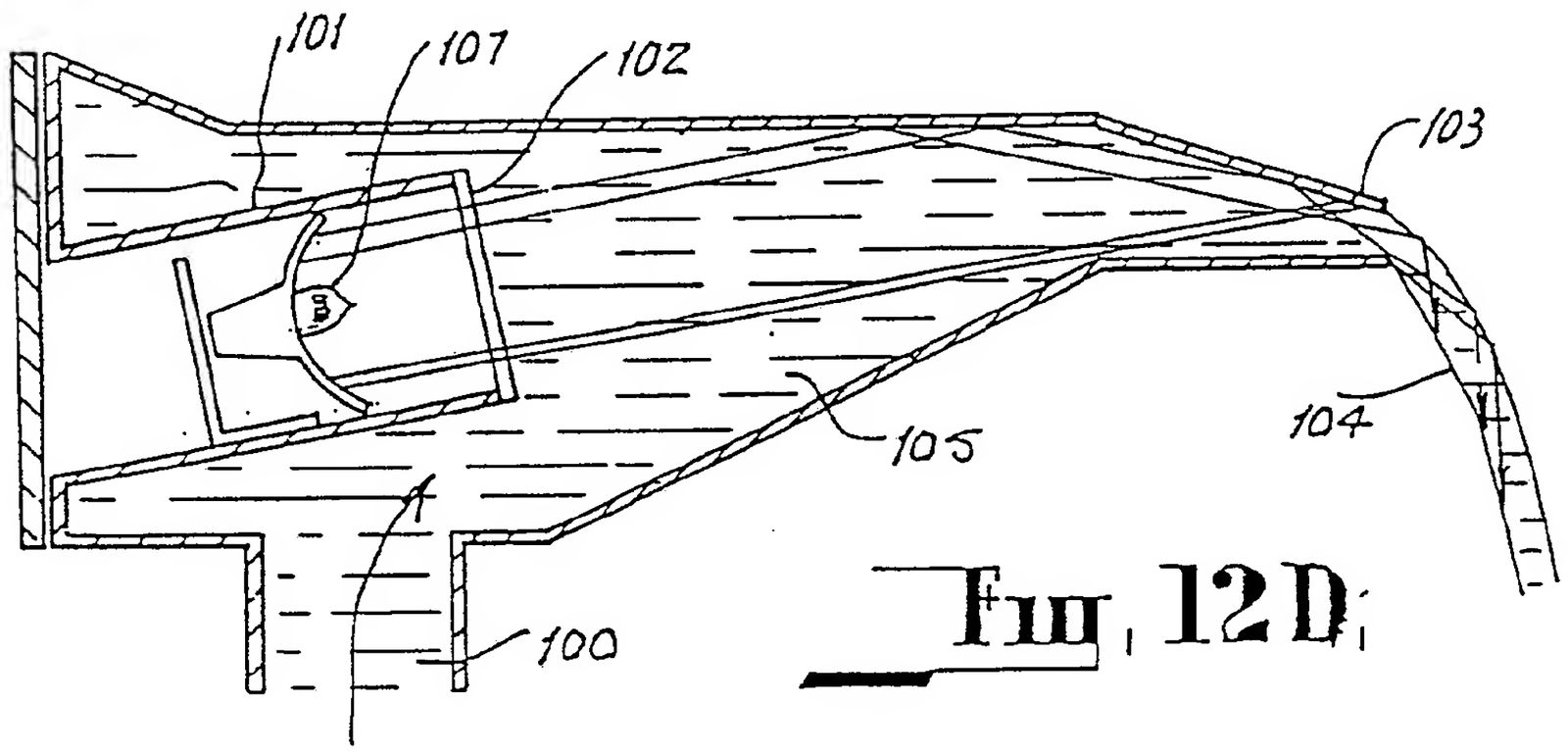

Fig. 12D

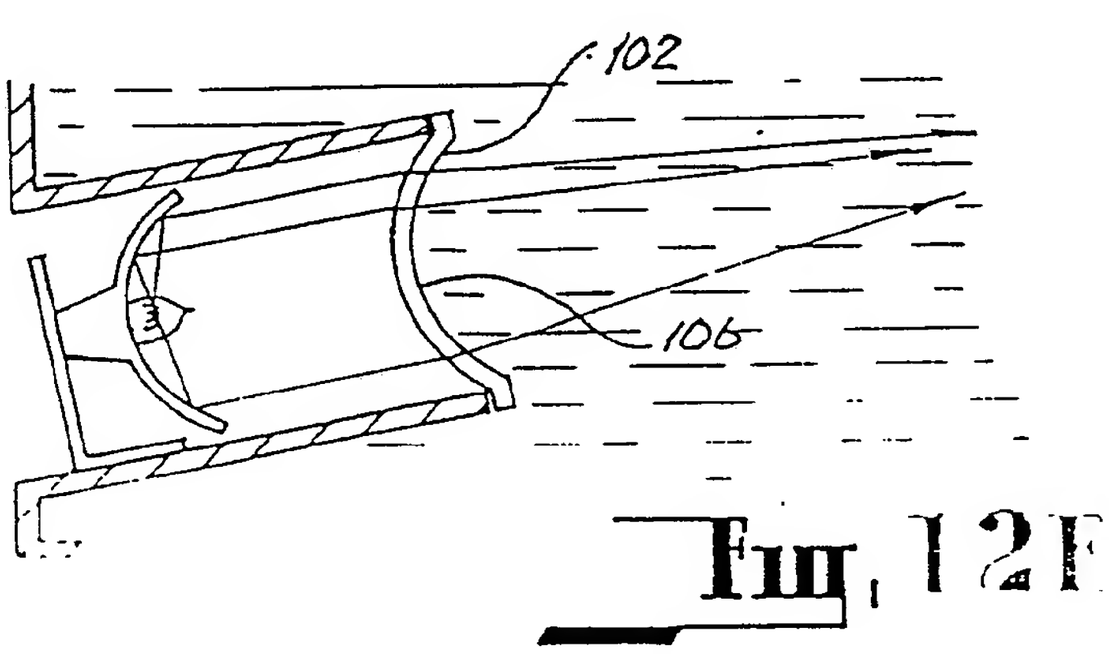

Fig. 12E

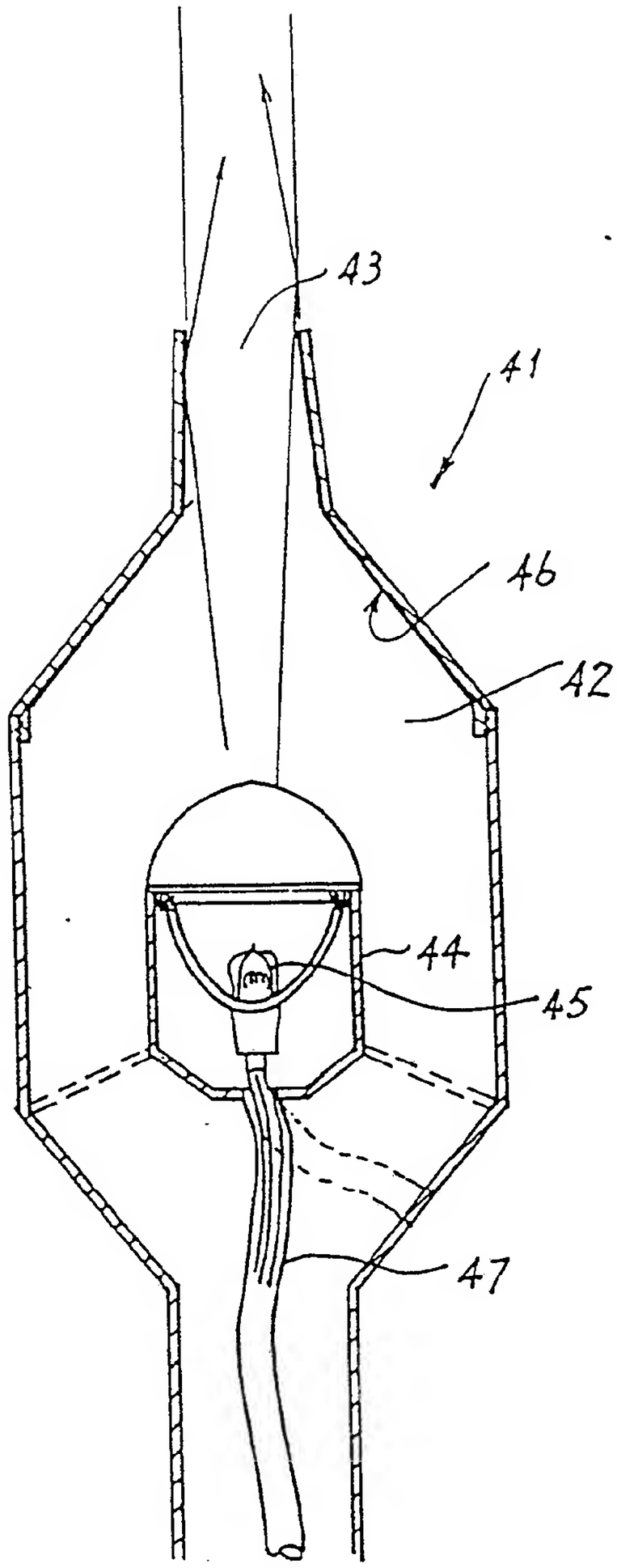

Fig. 13

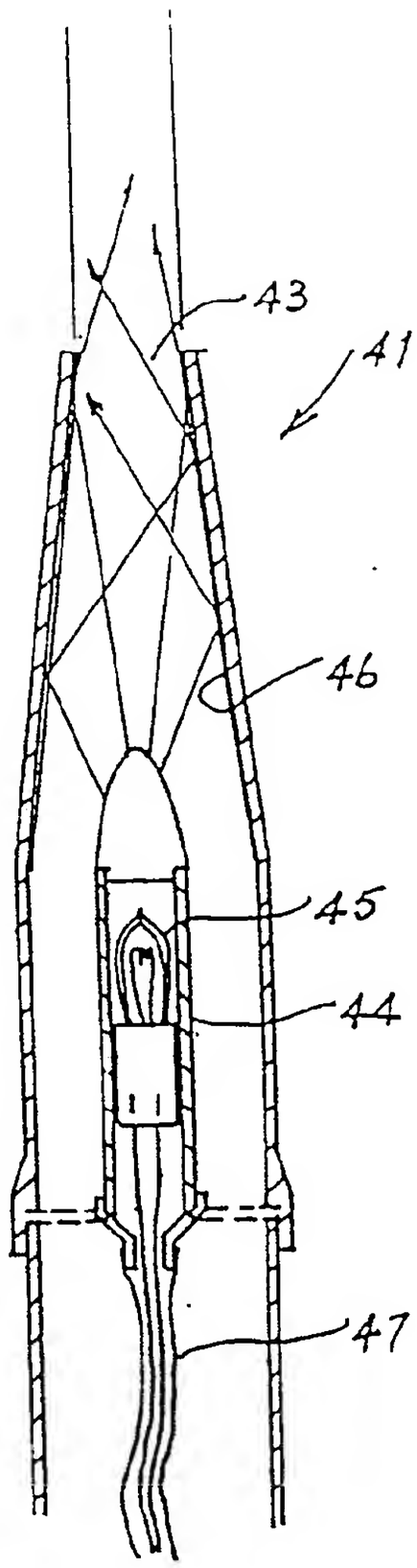

Fig. 14

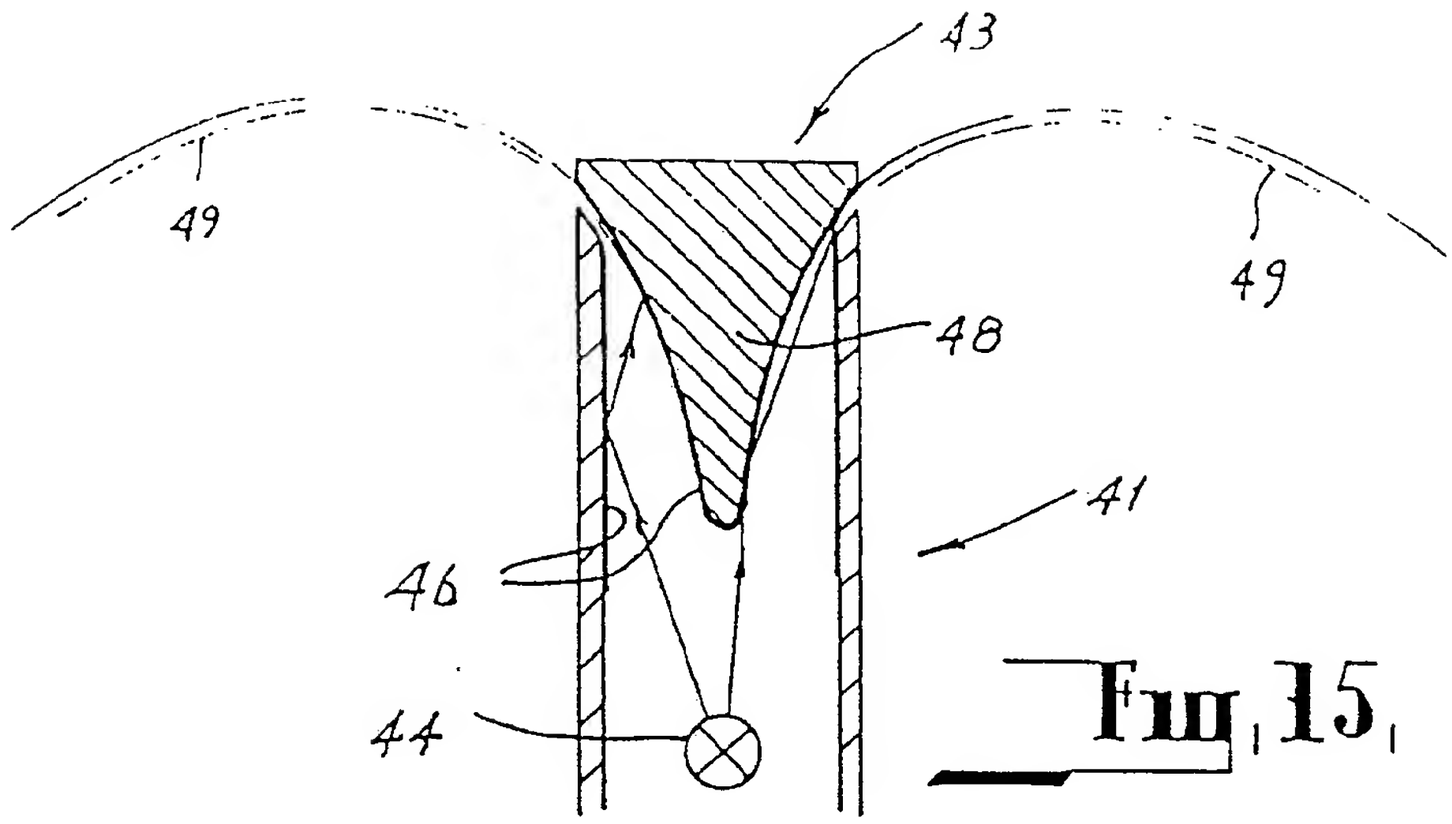

Fig. 15

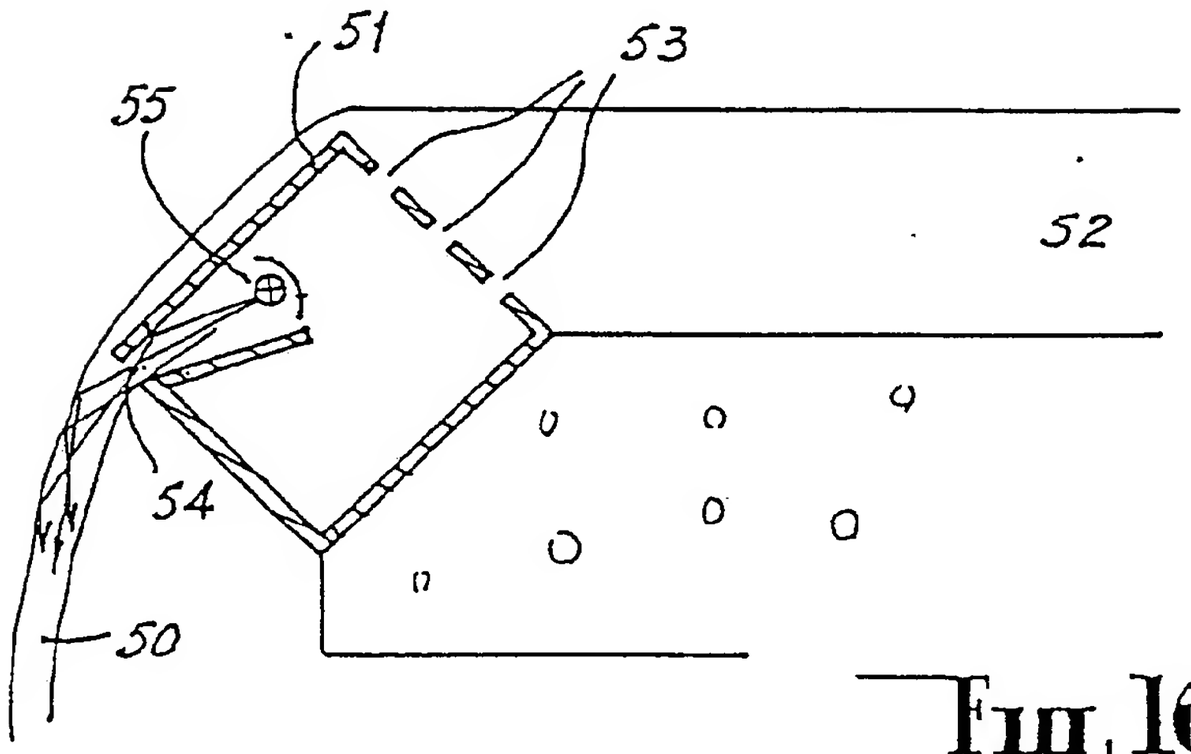

Fig. 16

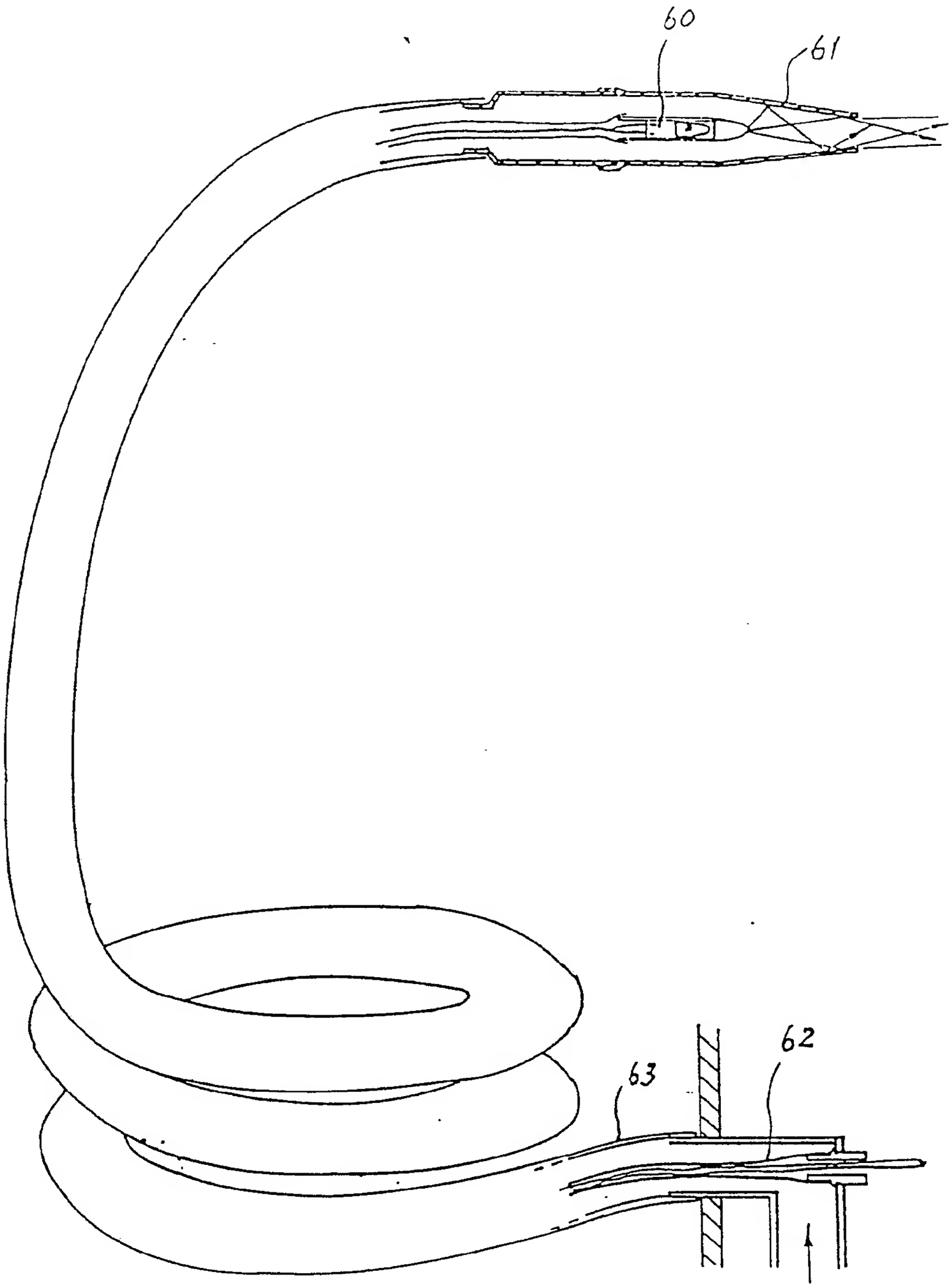

Fig. 17